HEATHKIT® MANUAL

HEATH COMPANY • BENTON HARBOR, MICHIGAN

HEATH COMPANY PHONE DIRECTORY

The following telephone numbers are direct lines to the departments listed:

Kit orders and delivery information	(616) 982-3411
Credit	(616) 982-3561
Replacement Parts	(616) 982-3571

Technical Assistance Phone Numbers
8:00 A.M. to 12 P.M. and 1:00 P.M. to 4:30 P.M., EST, Weekdays Only

Audio	(616) 982-3310
Amateur Radio	(616) 982-3296
Test Equipment, Weather Instruments and Home Clocks	(616) 982-3315
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Computers — Software:	
Operating Systems, Languages, Utilities	(616) 982-3860
Application Programs	(616) 982-3884

YOUR HEATHKIT 90-DAY LIMITED WARRANTY

Consumer Protection Plan for Heathkit Consumer Products

Welcome to the Heath family. We believe you will enjoy assembling your kit and will be pleased with its performance. Please read this Consumer Protection Plan carefully. It is a "LIMITED WARRANTY" as defined in the U.S. Consumer Product Warranty and Federal Trade Commission Improvement Act. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Heath's Responsibility

PARTS — Replacements for factory defective parts will be supplied free for 90 days from date of purchase. Replacement parts are warranted for the remaining portion of the original warranty period. You can obtain warranty parts direct from Heath Company by writing or telephoning us at (616) 982-3571. And we will pay shipping charges to get those parts to you . . . anywhere in the world.

SERVICE LABOR — For a period of 90 days from the date of purchase, any malfunction caused by defective parts or error in design will be corrected at no charge to you. You must deliver the unit at your expense to the Heath factory, any Heath/Zenith Computers and Electronics center (units of Veritechnology Electronics Corporation), or any of our authorized overseas distributors.

TECHNICAL CONSULTATION — You will receive free consultation on any problem you might encounter in the assembly or use of your Heathkit product. Just drop us a line or give us a call. Sorry, we cannot accept collect calls.

NOT COVERED — The correction of assembly errors, adjustments, calibration, and damage due to misuse, abuse, or negligence are not covered by the warranty. Use of corrosive solder and/or the unauthorized modification of the product or of any furnished component will void this warranty in its entirety. This warranty does not include reimbursement for inconvenience, loss of use, customer assembly, set-up time, or unauthorized service.

This warranty covers only Heath products and is not extended to other equipment or components that a customer uses in conjunction with our products.

SUCH REPAIR AND REPLACMENT SHALL BE THE SOLE REMEDY OF THE CUSTOMER AND THERE SHALL BE NO LIABILITY ON THE PART OF HEATH FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO ANY LOSS OF BUSINESS OR PROFITS, WHETHER OR NOT FORESEEABLE.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Owner's Responsibility

EFFECTIVE WARRANTY DATE — Warranty begins on the date of first consumer purchase. You must supply a copy of your proof of purchase when you request warranty service or parts.

ASSEMBLY — Before seeking warranty service, you should complete the assembly by carefully following the manual instructions. Heathkit service agencies cannot complete assembly and adjustments that are customer's responsibility.

ACCESSORY EQUIPMENT — Performance malfunctions involving other non-Heath accessory equipment, (antennas, audio components, computer peripherals and software, etc.) are not covered by this warranty and are the owner's responsibility.

SHIPPING UNITS — Follow the packing instructions published in the assembly manuals. Damage due to inadequate packing cannot be repaired under warranty.

If you are not satisfied with our service (warranty or otherwise) or our products, write directly to our Director of Customer Service, Heath Company, Benton Harbor MI 49022. He will make certain your problems receive immediate, personal attention.

Heathkit® Manual

for the

45″ SUPER-SCREEN TV WITH REMOTE CONTROL

Model GR-4500

595-3438

WARNING: Do not expose this TV set to rain or moisture. Never operate the set if liquid has accidently spilled into it. If this should happen, have your set checked by a qualified service technician before you use it again. Fire or electric shock could result.

NOTE: Be sure to read the "Television Safety Guide."

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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WARRANTY . . . . . Inside front cover

CUSTOMER SERVICE . . . . . Inside rear cover

Federal Communications Commission requirements prescribe maximum RF radiation from Receivers operating above 30 MHz. This Television Receiver will meet these requirements when constructed in strict accordance with the instructions in this Manual, using only components and materials supplied with the kit or the exact equivalent thereof. In order to meet legal requirements, be certain to follow the instructions exactly as they are stated in this Manual.

INTRODUCTION

The GR-4500 Super-Screen TV is a fixed screen, 45-inch diagonal picture, rear projection television receiver. High definition, liquid-cooled projection tubes are used to provide you with a bright, high resolution, self-converged picture display. Optical coupling between the projection tubes and the projection optics enhance the display contrast. The screen utilizes high-gain contrast and extended viewer acceptance angle. Fault mode sensing and electronic shut down circuits protect the receiver in the event of a circuit failure. Most circuit boards (called "modules") and all critical assemblies are preassembled and factory aligned.

Many features, some of which are Heathkit exclusives, are standard with this Receiver. These features include:

Quartz-Controlled Electronic Tuning — Ends the need for fine-tuning adjustments. The tuner seeks out and locks on to the exact frequency you are tuned to. The picture always remains sharp and clear. Since the tuner is electronic, there are no moving parts to wear out and no contacts to corrode and cause picture problems.

Timed Entry Channel Selection — Allows you to select a channel and, after a three second delay, the channel will be tuned in automatically. For an immediate selection entry, select the channel and press the ENTER button.

Parental Control (PC) — Allows you to "lock-out" any channel(s) you do not wish others to view. This feature remains in effect for up to 12 hours when you enter a personal code of up to four digits in the TV's memory circuit.

Infrared Remote Control — Allows you to turn the Television on and off, change the channel, control the volume, recall the channel and time display, select stereo TV sound and activate the parental control to lock out undesired channels, and operate the optional antenna switch. Infrared operation improves reliability and reduces inadvertent operation due to noise.

Up/Down Channel Scanning — Allows you to scan your favorite channels in an up or down sequence. Once programmed, a microcomputer "remembers" your favorite channels, for tuning ease and convenience. A channel flashback function allows you to channel "hop."

On-Screen Channel Number and Time Display — Shows you the channel number you are watching and the time. The display will show for approximately 4-1/2 seconds whenever you change channels or whenever you press the RECALL button on your remote control or the TV's keyboard.

Phase-Lock Loop Tuning — "Locks-in" the signal for normal TV operation when switched to the NORM position. In the SPCL (special) position, the tuner pulls in off-frequency signals that may be received from cable antenna systems, master antenna (MATV) systems, video games, or other signal sources.

HRC Cable — Provides for operation on the newer technology cable systems which reduce interference from off-the-air stations.

Electronic Power Sentry Voltage Regulator — Helps conserve energy and maintain stable voltage to the Television circuits.

Special Video Filter — When it is switched in, this filter removes excess picture static (sometimes called "picture noise or snow") to give you a clearer picture, even under weak signal conditions.

Redi-Plug Provision — An access port allows easy connection of future accessories, such as a Teletext decoder, selected cable TV, and subscription TV decoders.

Magic-Touch Tuning — Features a "membrane" keypad control panel with quick response action. Just press the keypad on the panel to activate the desired functions.

Crosshatch Generator — For performing convergence and picture geometry adjustments.

Comb Filter — For greater picture resolution.

Stereo Control Center — Features separate stepped position bass and treble controls, a balance control to adjust the left and right channel levels, and a mode switch for AUX (auxiliary) STEREO, or TV audio.

Stereo Power Amplifier — With an output of 5-watts rms power per channel from 100 Hz to 10,000 Hz into 8 ohms, with 2% or less total harmonic distortion.

A Four-Speaker Sound System — Which includes two 6-1/2″ speakers for mid-and bass frequencies, and two 2-1/2″ tweeters for clean, clear, high frequencies.

The GR-4500 45″ Super-Screen TV with Remote Control and all of its advanced features is designed for many years of convenient entertainment and trouble-free performance.

UNPACKING INSTRUCTIONS

Do NOT unpack your kit until you are instructed to do so.

WARNING: Do not make adjustments to the pre-wired circuit board modules. These modules were tested and adjusted at the factory and must not be readjusted unless you are specifically instructed to do so in this Manual.

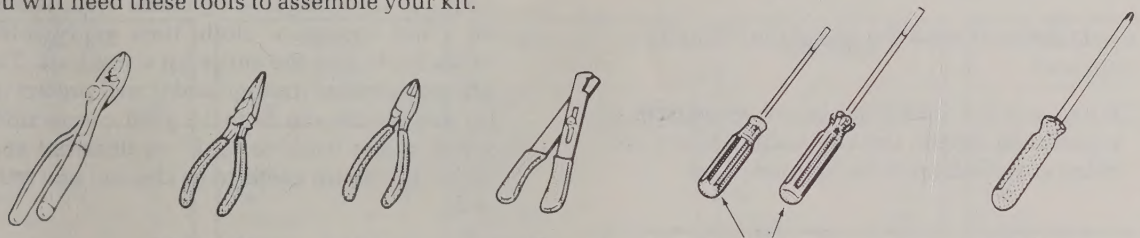
This 45" Super-Screen TV is packed in two cartons. The largest carton, marked "GR-4500 2 of 2", contains the cabinet, screen, mirror, and picture tube assembly. The other carton, marked "GR-4500 1 of 2", contains a smaller box marked "Pack 1 MISC FNL" and the remaining TV components, some of which are wrapped in their own packaging. These remaining loose parts will be referred to as "final pack" parts.

The instructions at the beginning of each Parts List tell you which carton and pack to open.

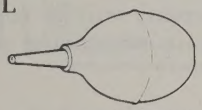
ASSEMBLY NOTES

TOOLS

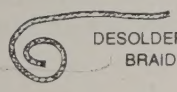
You will need these tools to assemble your kit.

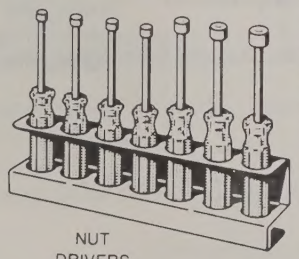


OTHER HELPFUL TOOLS


DESOLDERING BULB*

NUT STARTER (May Be Supplied With Kit)


DESOLDERING BRAID*


NUT DRIVERS

*To Remove Solder From Circuit Connections.

PENCIL SOLDERING IRON (22 to 25 WATTS)

ASSEMBLY

1. Follow the instructions carefully. Read the entire step before you perform each operation.

2. Refer to the separate "Illustration Booklet" for the Pictorials and Details. Keep the "Illustration Booklet" with the Assembly Manual. The illustrations in it are arranged in the proper sequence, as called for in the steps.

3. Pictorials show the overall operation for a group of assembly steps; Details generally illustrate a single step. When you are directed to refer to a certain Pictorial "for the following steps," continue using that Pictorial until you are referred to another Pictorial for another group of steps.

4. Position all parts as shown in the Pictorials.

5. Solder instructions are generally given only at the end of a series of similar steps. You may solder more often if you desire.

6. Each circuit part in an electronic kit has its own component number (R2, C4, etc.). Use these numbers when you want to identify the same part in the various sections of the Manual. These numbers, which are especially useful if a part has to be replaced, appear:

   — In the Parts List,

   — At the beginning of each step where a component is installed,

   — In some illustrations,

   — In Troubleshooting Charts,

   — In the Schematic,

   — In the sections at the rear of the Manual.

7. When you are instructed to cut something to a particular length, use the scales (rulers) provided at the bottom of the Manual pages.

SAFETY WARNING: Avoid eye injury when you cut off excessive lead lengths. Hold the leads so they cannot fly toward your eyes.

SOLDERING

Soldering is one of the most important operations you will perform while assembling your kit. A good solder connection will form an electrical connection between two parts, such as a component lead and a circuit board foil. A bad solder connection could prevent an otherwise well-assembled kit from operating properly.

It is easy to make a good solder connection if you follow a few simple rules:

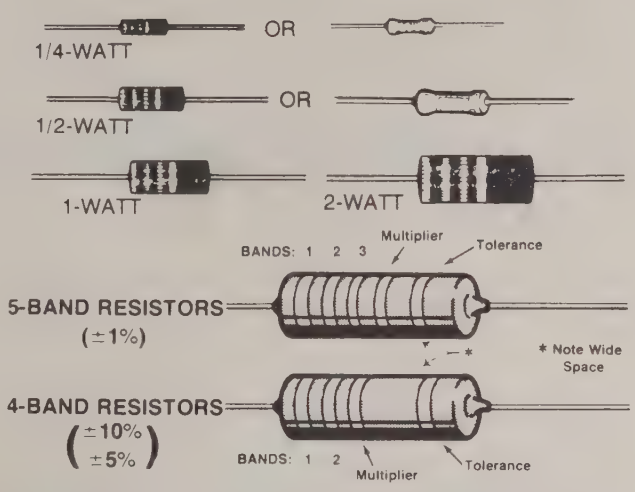
1. Use the right type of soldering iron. A 22 to 25-watt pencil soldering iron with a 1/8″ or 3/16″ chisel or pyramid tip works best.

2. Keep the soldering iron tip clean. Wipe it often on a wet sponge or cloth; then apply solder to the tip to give the entire tip a wet look. This process is called tinning, and it will protect the tip and enable you to make good connections. When solder tends to "ball" or does not stick to the tip, the tip needs to be cleaned and retinned.

NOTE: Always use rosin core, radio-type solder (60:40 tin-lead content) for all of the soldering in this kit. This is the type we have supplied with the parts. The Warranty will be void and we will not service any kit in which acid core solder or paste has been used.

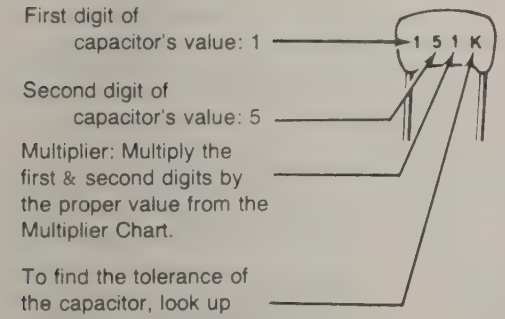
PARTS

Resistors are identified in Parts Lists and steps by their resistance value in Ω (ohms), kΩ (kilohms), or MΩ (megohms). They are usually identified by a color code of four or five color bands, where each color represents a number. These colors (except for the last band, which indicates a resistor's "tolerance") will be given in the steps in their proper order. Therefore, the following color code is given for information only. NOTE: Occasionally, a "precision" or "power" resistor may have the value stamped on it.



Band 1 1st Digit		Band 2 2nd Digit		Band 3 (if used) 3rd Digit		Multiplier		Resistance Tolerance	
Color	Digit	Color	Digit	Color	Digit	Color	Multiplier	Color	Tolerance
Black	0	Black	0	Black	0	Black	1	Silver	± 10%
Brown	1	Brown	1	Brown	1	Brown	10	Gold	± 5%
Red	2	Red	2	Red	2	Red	100	Red	± 2%
Orange	3	Orange	3	Orange	3	Orange	1,000	Brown	± 1%
Yellow	4	Yellow	4	Yellow	4	Yellow	10,000	Green	± 5%
Green	5	Green	5	Green	5	Green	100,000	Blue	± 25%
Blue	6	Blue	6	Blue	6	Blue	1,000,000	Violet	± 1%
Violet	7	Violet	7	Violet	7	Silver	0.01	Gray	± 05%
Gray	8	Gray	8	Gray	8	Gold	0.1		
White	9	White	9	White	9				

Capacitors will be called out by their capacitance value in μF (microfarads) or pF (picofarads) and type: ceramic, Mylar*, electrolytic, etc. Some capacitors may have their value printed in the following manner:


First digit of capacitor's value: 1
Second digit of capacitor's value: 5
Multiplier: Multiply the first & second digits by the proper value from the Multiplier Chart.
To find the tolerance of the capacitor, look up this letter in the Tolerance columns.
1 5 1 K

EXAMPLES:

151K = 15 × 10 = 150 pF
759 = 75 ×0.1 = 7.5 pF

NOTE: The letter "R" may be used at times to signify a decimal point: as in: 2R2 = 2.2 (pF or μF).

MULTIPLIER		TOLERANCE OF CAPACITOR		
FOR THE NUMBER:	MULTIPLY BY:	10 pF OR LESS	LETTER	OVER 10 pF
0	1	± 0.1 pF	B	
1	10	± 0.25 pF	C	
2	100	± 0.5 pF	D	
3	1000	± 1.0 pF	F	± 1%
4	10,000	± 2.0 pF	G	± 2%
5	100,000		H	± 3%
			J	± 5%
8	0.01		K	± 10%
9	0.1		M	± 20%

*DuPont Registered Trademark.

CROSSHATCH CIRCUIT BOARD

PARTS LIST

Open the box marked "GR-4500 1 of 2." Then open the smaller carton marked "Pack #1 MISC FNL" and remove Pack 1 only. This pack is identified on the "Pack Index Sheet" located inside the carton. Set the remaining MISC FNL parts aside until they are called for.

Check each part against the following list. The key numbers correspond to the numbers on "Crosshatch Circuit Board Parts Pictorial" (Illustration Booklet, Pages 1 and 2). Return any part that is in an individual envelope back into the envelope after you have identified it, until that part is called for in a step. Do not throw away any packing material until you account for all the parts.

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover of this Manual. For prices, refer to the separate "Heath Parts Price List."

NON-TAPED PARTS

NOTE: The following parts are not taped on strips. The key numbers correspond to the numbers on "Crosshatch Circuit Board Parts Pictorial."

CAPACITORS

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
A1	20-118	1	15 pF mica	C903
A1	20-115	1	300 pF mica	C902
A2	27-47	4	.1 μF Mylar	C901, C905, C906, C907
A3	25-885	1	100 μF electrolytic	C904

TRANSISTORS — INTEGRATED CIRCUITS (ICs)

NOTE: Transistors and integrated circuits may be marked for identification in any one of the following four ways:

1. Part number.
2. Type number. (For integrated circuits, this refers only to the numbers and letters shown in **BOLD** print in the Parts List. Disregard any other numbers or letters shown on the IC.)
3. Part number and type number.
4. Part number with a type number other than the one shown.

CAUTION: Some of the integrated circuits can be easily damaged by static electricity. DO NOT remove any ICs from their foam pads until you are instructed to do so in a step.

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
B1	417-801	5	MPSA20 transistor	Q901 - Q905
B2	443-603	1	CD**4011** or **14011** IC	U901
B2	443-737	1	MC**14518** or **4518** IC	U902
B2	443-777	1	MC**14528** or **4098** IC	U903

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
LABELS				
C1	235-786	1	Heath nameplate	
C2	235-822	1	Audio/video label	
C3	235-838	1	Screw removal label	
C4	235-839	1	General fuse replacement label	
C5	235-840	1	Shock hazard warning label	
C6	235-841	1	X-ray warning label	
C7	235-845	1	CRT caution label	
C8	390-1192	1	Manufacturing date label	
C9	390-2819	1	Power consumption label	
C10		1	Blue and white label	
MISCELLANEOUS				
D1	10-312	1	10 kΩ control	R911
D2	60-645	1	Slide switch	SW901
	85-2903	1	Crosshatch circuit board	
D3	432-753	7	Spring connector (includes one extra)	
D4	432-1213	6	Female connector shell	

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
MISCELLANEOUS (Cont'd.)				
D5	434-298	1	14-pin IC socket	
D5	434-299	2	16-pin IC socket	
	597-260	1	Parts Order Form*	
	597-1766	1	Television Safety Guide*	
			Assembly Manual (see title page for part number)	
			Solder	
WIRE				
	344-50	39"	Black	
	344-52	27"	Red	
	344-54	39"	Yellow	
	344-55	42"	Green	
	344-56	39"	Blue	
	344-59	36"	White	

Parts in "MISC FNL" section of Pack #1 carton.

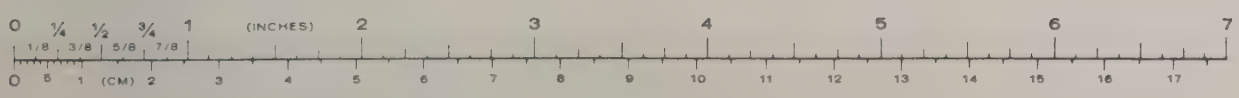
*These items are packed inside the Manual. Set them aside for use later.

TAPED COMPONENTS

NOTE: The following resistors and diodes are taped on a strip which was checked before shipment. Since these parts are taped in the order of assembly, it is not necessary to check them against the following list.

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
RESISTORS			
NOTE: All resistors are 1/4-watt, with a tolerance of 5% (fourth band gold) unless otherwise noted.			
6-221-12	1	220 Ω (red-red-brn)	R919
6-511	1	510 Ω, 1/2-watt (grn-brn-brn)	R921
6-222-12	1	2200 Ω (red-red-red)	R923
6-272-12	1	2700 Ω (red-viol-red)	R917
6-332-12	2	3300 Ω (org-org-red)	R902, R905
6-472-12	1	4700 Ω (yel-viol-red)	R924
6-682-12	1	6800 Ω (blue-gry-red)	R909
6-103-12	4	10 kΩ (brn-blk-org)	R907, R914, R916, R922

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
Resistors (Cont'd.)			
6-153-12	3	15 kΩ (brn-grn-org)	R903, R908, R915
6-273-12	1	27 kΩ (red-viol-org)	R912
6-333-12	2	33 kΩ (org-org-org)	R901, R904
6-104-12	2	100 kΩ (brn-blk-yel)	R906, R913
6-154-12	1	150 kΩ (brn-grn-yel)	R918
DIODES			
56-36	1	Zener	D905
56-56	2	1N4149	D901, D902



STEP-BY-STEP ASSEMBLY

START

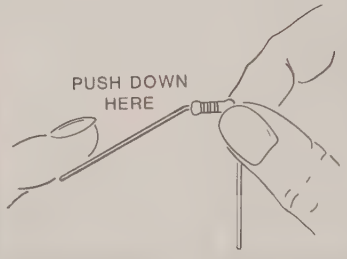
In the following steps, you will be given detailed instructions on how to install and solder the first part on the circuit board. Read and perform each step carefully. Then use the same procedure whenever you install parts on a circuit board.

( ) Position the crosshatch circuit board as shown with the printed side (not the foil side) up.

NOTE: When you install a component that has its value printed on it, position the value marking up, so it can be easily read. Diodes should be mounted with their type or part number up, if possible.

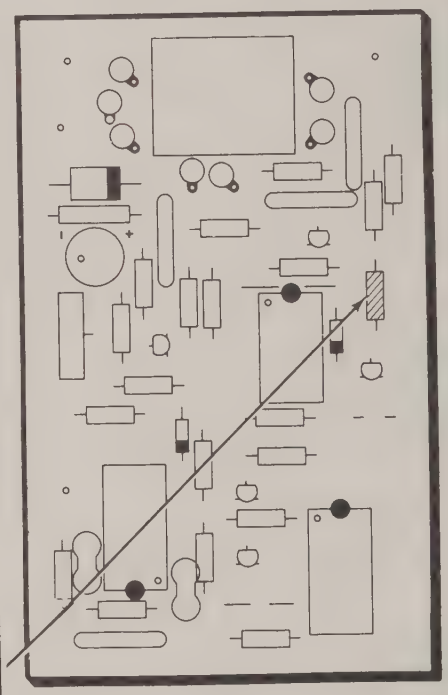
( ) Remove the "Taped Components Chart" from the last page of your Illustration Booklet. Refer to the instructions at the top of the chart to prepare the taped parts. Then install the following parts from the taped strip.

( ) Hold a 15 kΩ (brn-grn-org) resistor and bend the leads straight down to fit the hole spacing on the circuit board.



( ) R903: Push the leads through the holes at the indicated location on the circuit board.

( ) Press the resistor against the circuit board. Then bend the leads outward slightly to hold the resistor in place.

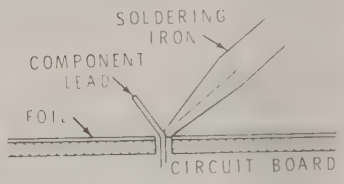


PICTORIAL 1-1

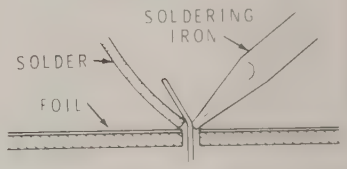
CONTINUE

( ) Solder the resistor leads to the circuit board as follows:

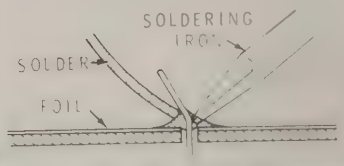
1. Push the soldering iron tip against both the lead and the circuit board foil. Heat **both** for two or three seconds.



2. Then apply solder to the other side of the connection. IMPORTANT: Let the heated lead and the circuit board foil melt the solder.

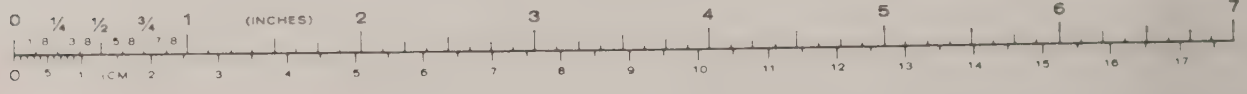


3. As the solder begins to melt, allow it to flow around the connection. Then remove the solder and the iron and let the connection cool.



( ) Cut off the excess lead lengths close to the connection. WARNING: Clip the leads so the ends will not fly toward your eyes.

( ) Check each connection. Compare it to Detail 1-1A in the Illustration Booklet. After you have checked the solder connections, proceed with the assembly. Use the same soldering procedure for each connection.



START

NOTE: Make sure you installed the resistor in Pictorial 1-1 on Page 12.

( ) R913: 100 kΩ (brn-blk-yel).

( ) R921: 510 Ω, 1/2-watt (grn-brn-brn).

( ) R923: 2200 Ω (red-red-red).

( ) R912: 27 kΩ (red-viol-org).

( ) R909: 6800 Ω (blu-gry-red).

( ) R922: 10 kΩ (brn-blk-org).

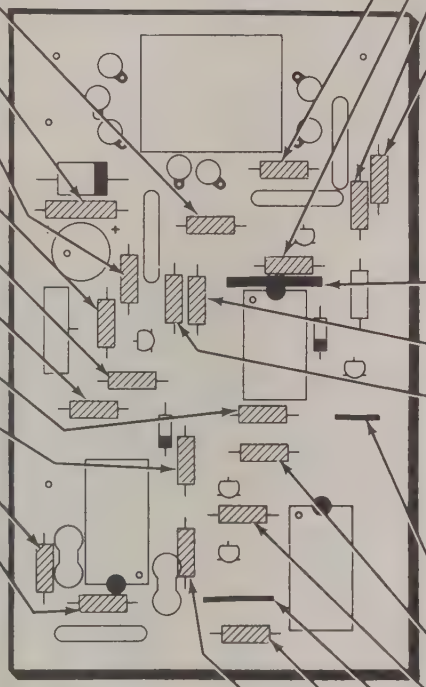
( ) R904: 33 kΩ (org-org-org).

( ) R918: 150 kΩ (brn-grn-yel).

( ) R917: 2700 Ω (red-viol-red).

( ) R916: 10 kΩ (brn-blk-org).

( ) Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 1-2

CONTINUE

( ) R914: 10 kΩ (brn-blk-org).

( ) R915: 15 kΩ (brn-grn-org).

( ) R901: 33 kΩ (org-org-org).

( ) R902: 3300 Ω (org-org-red).

NOTE: When a wire is called for, cut the wire to the indicated length and then remove 1/4" of insulation from each end. Solder the ends of the wires as you install them and cut off the excess wire lengths.

( ) 1-1/8" black wire.

( ) R924: 4700 Ω (yel-viol-red).

( ) R919: 220 Ω (red-red-brn).

( ) Remove all of the insulation from a 1-3/4" yellow wire. Use this wire when a step calls for bare wire.

( ) 3/4" bare wire.

( ) R905: 3300 Ω (org-org-red).

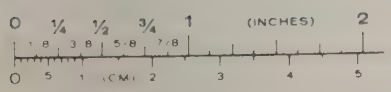
( ) R906: 100 kΩ (brn-blk-yel).

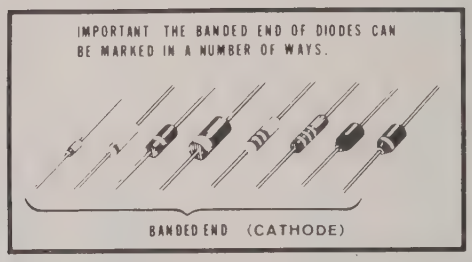
( ) 1" bare wire.

( ) R907: 10 kΩ (brn-blk-org).

( ) R908: 15 kΩ (brn-grn-org).

( ) Solder the leads to the foil and cut off the excess lead lengths.

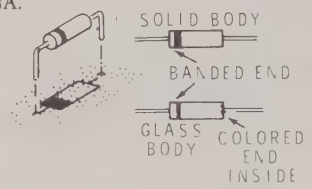




Detail 1-3A

START

NOTE: When you install a diode, always match the band on the diode with the band mark on the circuit board. THE CIRCUIT WILL NOT WORK PROPERLY IF A DIODE IS INSTALLED BACKWARDS. See Detail 1-3A.



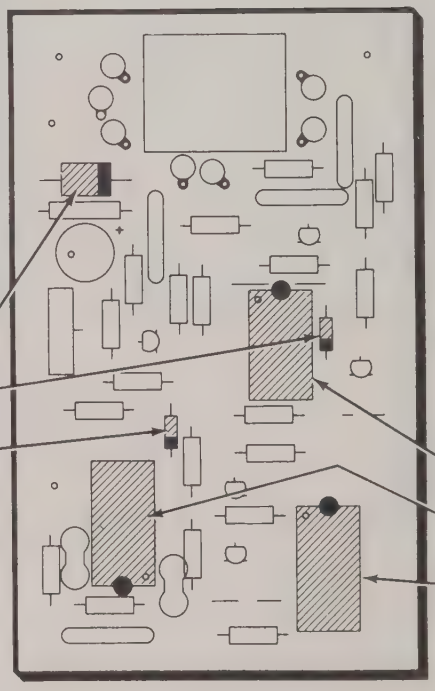
If your diode has a solid body, the band is clearly defined. If your diode has a glass body, do not mistake the colored end inside the diode for the banded end. Look for a band painted on the outside of the glass.

( ) D905: Zener diode (#56-36).

( ) D901: 1N4149 diode (#56-56).

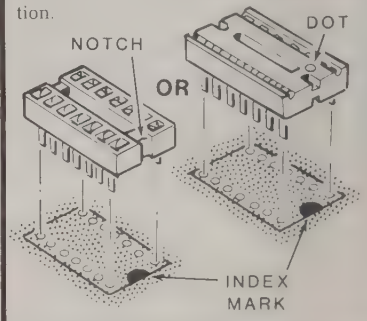
( ) D902: 1N4149 diode (#56-56).

( ) Solder the leads to the foil and cut off the excess lead lengths.



CONTINUE

NOTE: Before you install an IC socket, make sure the pins are straight. If there is any kind of identification mark (notch, dot, arrowhead, etc.) at or near one end of the socket, place this marked end toward the index mark on the circuit board (this index mark should still be visible after you install the socket). Then start the pins into the circuit board holes and solder them to the foil. Do not install a 14-pin socket at a 16-pin socket location.



( ) 14-pin IC socket at U901.

( ) 16-pin IC socket at U903.

( ) 16-pin IC socket at U902.

PICTORIAL 1-3

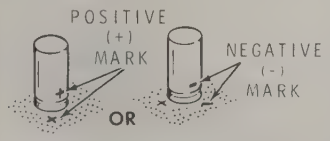
START

( ) C901: .1 μF Mylar.

( ) C905: .1 μF Mylar.

( ) C907: .1 μF Mylar.

NOTE: When you install an electrolytic capacitor, be sure to match the positive (+) mark on the capacitor with the positive (+) mark on the circuit board, or match the negative (−) mark on the capacitor with the negative (−) mark on the circuit board.



( ) C904: 100 μF electrolytic.

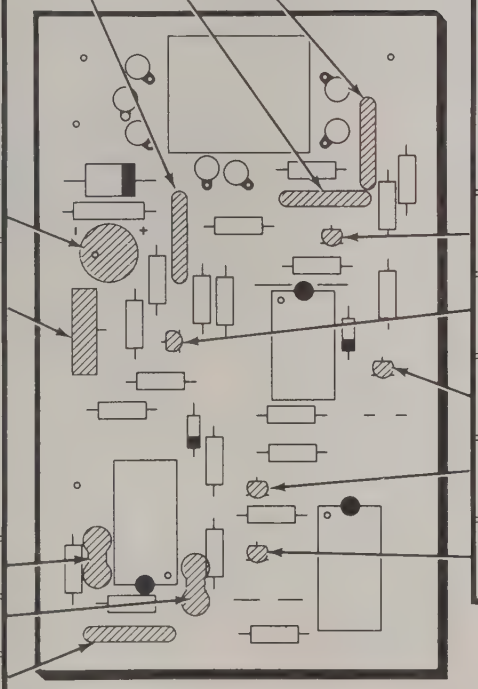
( ) R911: 10 kΩ control. Solder the lugs to the foil.

( ) C903: 15 pF mica.

( ) C902: 300 pF mica.

( ) C906: .1 μF Mylar.

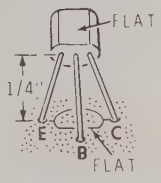
( ) Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 1-4

CONTINUE

NOTE: When you install a transistor in each of the following steps, align its flat with the flat on the circuit board. Insert the leads into their correct holes. Position the transistor 1/4" above the circuit board. Then solder the leads to the foil and cut off the excess lead lengths.



( ) Q904: MPSA20 transistor (#417-801).

( ) Q905: MPSA20 transistor (#417-801).

( ) Q901: MPSA20 transistor (#417-801).

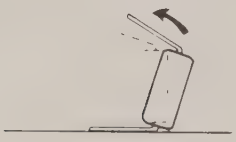
( ) Q902: MPSA20 transistor (#417-801).

( ) Q903: MPSA20 transistor (#417-801).

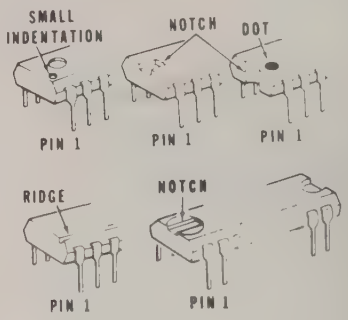
Once you remove a protected IC from its protective foam packing, DO NOT lay the IC down or let go of it until it is installed in its socket. When you bend the leads of a protected IC, hold the IC in one hand and place your other hand on your work surface before you touch the IC to your work surface. This will equalize the static electricity between the work surface and the IC.

The pins on the IC's may be bent out at an angle, so they do not line up with the holes in the IC socket. DO NOT try to install an IC without first bending the pins as described below. To do so may damage the IC pins or the socket, causing intermittent contact.

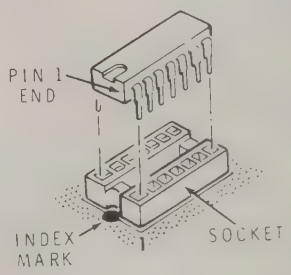
Before you install an IC, lay it down on its side as shown below and very carefully roll it toward the pins to bend the lower pins into line. Then turn the IC over and bend the pins on the other side in the same manner.



Compare the IC to the drawing shown below. Then determine which end of the IC is the pin 1 end.



Position the pin 1 end of the IC over the index mark on the circuit board. Then start the IC pins into the socket. Make sure that all of the pins are started into the socket. Then push the IC firmly into the socket. NOTE: An IC pin can become bent under the IC and it will appear as though it is correctly installed in the socket.

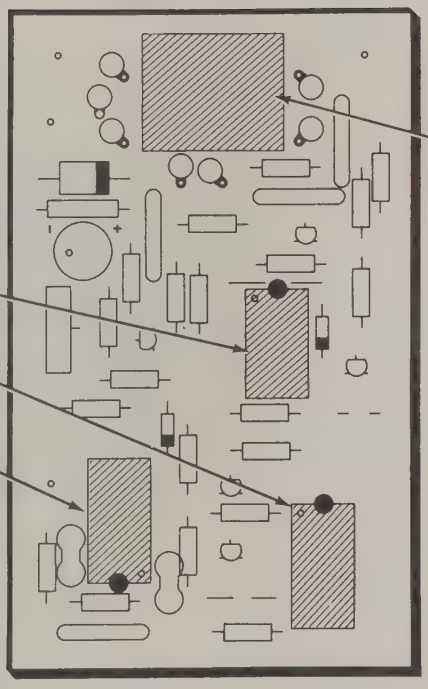


START

( ) U901: CD**14011**AE IC (#443-603) at U901.

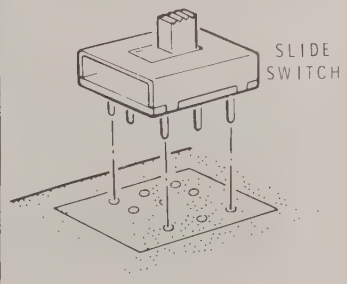
( ) U902: MC**14518** IC (#443-737) at U902.

( ) U903: MC**14528** or **4098** IC (#443-777) at U903.



CONTINUE

( ) SW901: Slide switch. Make sure the lugs are fully seated into the circuit board holes, then solder the lugs to the foil.



PICTORIAL 1-5

Refer tp Pictorial 1-6 for the following steps.

( ) Cut a 6″ white wire and set it aside.

( ) Cut a 8″ black wire and set it aside.

NOTE: When you are instructed to prepare the following solid wires, remove 1/8″ of insulation from one end and 1/4″ of insulation from the other end of the wire color called out in the step. Use the remaining wire lengths (except for the 6″ white and the 7″ black wires you just set aside).

( ) Prepare the ends of the following wires:

Black
Red
Yellow
Green
Blue
White

( ) Refer to the inset drawing and crimp and solder a spring connector on the 1/8″ prepared end of each of the six wires.

( ) Refer to the inset drawing and slide the spring connector on the end of each prepared wire, into a 1-hole connector shell with the connector shell and the small locking tab on the spring connector positioned as shown. Push the spring connector into the connector shell until it locks into place. Pull out on the wire to make sure that it is locked securely in place.

Connect the free end of each prepared wire into the circuit board as follows. After you connect each wire, solder it to the foil and cut off the excess lead lengths:

( ) Blue wire to hole B.

( ) Black wire to hole G.

( ) Yellow wire to hole A.

( ) Green wire to hole E.

( ) Red wire to hole F.

( ) White wire to hole C.

NOTE: Hole D will not be used.

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following possible problems.

( ) Unsoldered connections.

( ) Poor solder connections.

( ) Solder bridges between foil patterns.

( ) Protruding leads which could touch together.

Refer to the illustration where the parts were installed as you make the following visual checks.

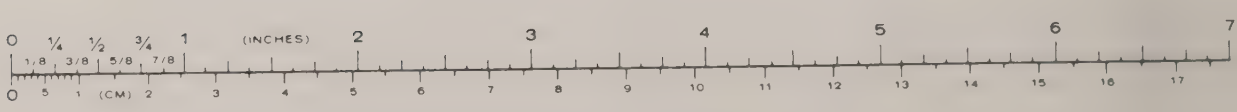
( ) Transistors for the proper type and installation.

( ) ICs for the proper type and installation.

( ) Diodes for the proper type and positioning of the banded end.

( ) Electrolytic capacitors for the correct position of the positive (+) and negative (−) marked ends.

This completes the circuit board assembly. Set it aside until it is called for later.



CABINET

PARTS LIST

NOTE: When you unpack the remainder of the kit, be careful not to damage the fragile parts (speakers, modules, etc.).

Open the carton marked "GR-4500 2 of 2" and remove the cabinet assembly. Then remove the remaining parts from the carton marked "GR- 4500 1 of 2" and check each part against the following list. The key numbers correspond to the numbers on the "Cabinet Parts Pictorial." Return any part that is in an individual envelope back into the envelope after you have identified it, until that part is called for in a step. Do not throw away any packing material until you account for all the parts.

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover of this Manual. For prices, refer to the separate "Heath Parts Price List."

RESISTORS

NOTE: The following resistors are 1/4-watt, with a tolerance of 5% (fourth band gold) unless otherwise noted.

KEY No.	HEATH Part No.	QTY.	DESCRIPTION
A1	6-750-12	1	75 Ω (viol-grn-blk)
A1	6-222-12	2	2200 Ω (red-red-red)
A1	6-113-12	1	11 kΩ, 1/2-watt (brn-brn-org)
A2	235-740	2	2.2 Ω, 5%, 3-watt wire-wound

ASSEMBLIES & MODULES

KEY No.	HEATH Part No.	QTY.	DESCRIPTION
	235-716	1	Cabinet and CRT assembly*
B1	235-1006	1	Focus control assembly
B2	235-714	1	Antenna balun assembly
B3	235-727	1	Infrared detector assembly
B4	235-728	1	Light sensor and stereo LED assembly
B5	235-744	1	Control assembly
B6	235-748	1	Slide switch assembly
B7	235-759	1	Video IF module
B8	235-760	1	Chroma/luminance module
B9	235-761	1	Sweep module
B10	235-1007	3	Video output module
B11	235-763	1	Focus module
B12	235-764	1	Raster registration module
B13	235-765	1	Audio & video isolation module
B14	235-766	1	Stereo decoder module
B15	235-767	1	Switch mode power supply module
B16	235-768	1	Stereo IF module
B17	235-769	1	Stereo interface module
B18	235-770	1	Tuner control module
B19	235-771	1	Stereo amplifier module
B20	235-853	1	Remote control transmitter
B21	235-857	1	Tuner module

*Refer to "Miscellaneous" on Page 21 for a list of the parts included in your cabinet assembly.

KEY No.	HEATH Part No.	QTY.	DESCRIPTION

CABLE ASSEMBLIES

NOTE: A cable marked "4P6/6P9" (for example) means that the cable has two connectors, and both are marked with this number/letter combination. A cable marked "6K3-3N-3F" means that the cable has three connectors, one marked "6K3," another marked "3N," and another marked "3F."

	235-712	1	Line cord w/connector 3R8
C1	235-717	1	8" shielded cable
	235-724	1	6O9 cable
	235-733	1	Brown wire assembly w/push-on connectors
	235-734	1	Red wire assembly w/push-on connectors
	235-735	1	4B4 cable
	235-736	1	4E9 cable
	235-737	1	2A cable
	235-738	1	8B4 cable
	235-739	1	8J4 cable
C2	235-741	1	Wire w/eyelet & push-on connector
C3	253-743	1	Wire w/eyelets
C4	235-747	1	Two wires w/eyelets & push-on connector
	235-750	1	6A6 cable
	235-751	1	6B6-6C6 cable
	235-790	1	4P6-6P9 cable
	235-791	1	4P8/8P4 cable
	235-792	1	4G3/3G4 cable
	235-793	2	5C/5C cable
	235-794	1	4H/5C cable
	235-795	1	4A6/6J4 cable
	235-796	1	1C9-3H cable
	235-797	1	3E4-4E3 cable
	235-798	1	2G/8H cable
	235-799	1	3A-8A cable
	235-800	1	6M1/1K6 cable
	235-801	1	2A-4K cable
	235-802	1	3D-8C cable
	235-803	1	6A9-2W6 cable
	235-804	1	6I2-2H cable
	235-805	1	4R9-6R9 cable
	235-806	1	4S6-6S9 cable
	235-807	1	1D4-4D1 cable
	235-808	1	2Q/5DB cable
	235-809	1	2P/5DG cable
	235-810	1	2N/5DR cable
	235-811	1	1Q3-3J cable
	235-812	1	6K3-3N-3F cable
	235-813	1	6G4-1F cable
	235-814	1	6H9 cable
	235-815	1	1J6-6L1 cable
	235-816	1	3S-4J8 cable
	235-817	1	6Y2-6Q2-2X cable
	235-818	1	1B-2C cable
	235-819	1	3B-5G cable
	235-820	3	5B-5H cable
	235-821	1	2F-3C cable
	235-823	1	4G3-8F4 cable
	235-824	1	6Z9-4B6 cable
	235-825	1	3R-8O3 cable
	235-826	1	1A4-8A4 cable
	235-827	1	4A1-8N6 cable
	235-828	1	1A-3M cable
	235-829	1	4Q6-6W9 cable
	235-830	1	6N9 cable
	235-831	1	12-1/2" shielded cable w/right-angle plug
	235-832	2	16" shielded cable
	235-834	1	30" shielded cable
	235-842	1	8G6 cable
	235-843	1	4A3 cable
	235-844	1	6T9-8O4-8E7 cable

PLASTIC & NYLON PARTS

D1	235-145	3	Small wire tie
D1	235-146	8	Medium wire tie
D1	235-350	1	Large wire tie
D2	235-783	22	Wire tie standoff (includes 1 extra)
D3	235-637	1	Round plug
D4	235-670	1	Strain relief
D5	235-752	1	Control escutcheon
D6	235-756	1	Door latch/catch assembly
D7	235-784	2	Beaded cable tie
D8	354-7	2	8" cable tie
D9	354-5	6	4" cable tie
D10	235-854	1	Round standoff
D11	235-855	2	Standoff w/ears
D12	235-856	2	Wall spacer
D13	235-485	2	Square standoff
D14	432-753	1	Spring connector
D15	432-1213	1	Female connector shell
D16	235-858	1	Infrared window
D17	490-1	1	Alignment tool
D18	490-5	1	Nut starter
D19	235-785	1	Control cover
D20	235-787	2	Module frame

TAPE – SHIELDS – GASKET – INSULATORS

E1	73-207	60"	1" wide foam tape
E2	235-754	2	RF shield
E3	235-758	1	Keyboard socket holder
E4	235-502	4	Round light shield
E5	235-862	1	Viewing port light shield
E6	235-863	1	Top light shield
E7	235-864	1	Left light shield
E8	235-865	1	Right light shield
E9	235-866	1	Switch mode power supply insulator
E10	235-867	1	Stereo IF insulator
E11	235-868	3	Video output module insulator

KEY No.	HEATH Part No.	QTY.	DESCRIPTION

BRACKETS

F1	204-2926	1	Crosshatch mounting bracket
F2	235-715	1	Stereo interface mounting bracket
F3	235-719	2	Chroma/raster registration mounting bracket
F4	235-720	1	High voltage mounting bracket
F5	235-721	1	Video IF mounting bracket
F6	235-722	1	Switch mode power supply mounting bracket
F7	235-732	1	Audio/video panel
F8	235-723	1	Antenna terminal bracket
F9	235-772	1	Focus control mounting bracket
F10	235-773	1	Line cord bracket
F11	235-774	2	Stereo IF mounting bracket
F12	235-776	1	Left amplifier mounting bracket
F13	235-777	1	Right amplifier mounting bracket
F14	235-778	2	Control panel mounting bracket
F15	235-779	3	Small retaining bracket
F16	235-775	2	Large retaining bracket
F17	235-729	1	Infrared housing assembly
F18	235-782	1	Tuner support bracket

HARDWARE

NOTE: The hardware is shown full size so you can place any nut, screw, etc, you are uncertain about over the drawing. Also, the hardware may be packed in more than one envelope. Open all of the envelopes (marked HDW) before you check the hardware against the Parts List.

#2 & #4 Hardware

G1	235-489	2	M2.6 × 10 mm phillips screw
G2	250-1411	2	4-40 × 1/4″ phillips screw
G3	235-755	2	#4 × 5/16″ phillips self-tapping screw

#6 Hardware

H1	235-731	2	6-20 × 1/4″ hex-head screw
H2	235-869	1	6-20 × 7/16″ hex-head screw

#8 Hardware

J1	235-847	2	8-18 × 5/16″ hex-head screw
J2	235-852	4	8-18 × 3/8″ hex-head screw w/lockwasher
J3	235-190	11	8-10 × 1/2″ hex-head screw
J4	235-848	30	8-18 × 1/2″ hex-head screw
J5	235-399	2	8-10 × 5/8″ hex-head screw
J6	235-849	15	8-18 × 5/8″ hex-head screw
J7	235-851	10	8-15 × 3/4″ hex-head screw w/flat washer
J8	235-850	3	8-18 × 1-1/2″ hex-head screw
J9	235-846	2	8-18 × 2-1/4″ phillips screw
J10	235-753	2	8-32 × 13/32″ setscrew

KEY No.	HEATH Part No.	QTY.	DESCRIPTION

Other Hardware

K1	235-730	1	1/4″ hex nut
K2	235-836	12	5/16″ hex nut
K3	235-835	17	11/32″ hex nut w/lockwasher
K4	252-7	1	3/8″ hex nut
K5	235-557	2	3/16″ × 3/8″ adhesive fiber washer
K6	235-742	1	1/8″ × 3/8″ adhesive fiber washer

MISCELLANEOUS

L1	235-749	1	Door
L2	235-745	1	Keyboard membrane switch
L3	235-746	3	Knob
L4	235-788	2	2-1/2″ speaker
L5	235-789	2	6-1/2″ speaker
L6	235-725	1	Coaxial connector
L7	235-726	1	Round 3-hole socket
	346-1	3″	Fiber sleeving
L8	490-29	1	1/4″ nut driver
L9	490-168	1	1/4″ × 5/16″ open end wrench
L10	490-229	1	1/4″ × 11/32″ open end wrench
L11	432-176	1	Strip of four stakes
	235-713	1	Screen cleaning kit
L12	261-29	1	Foot

The following parts are included in your television cabinet assembly.

235-876	Mirror
235-877	Screen
235-871	Red picture tube replacement kit*
235-872	Green picture tube replacement kit*
235-873	Blue picture tube replacement kit*
235-874	Green optical coupling pad
235-875	Red/Blue optical coupling pad

The following parts are included in your control assembly.

235-679	Color, tint control
235-681	Black level control
235-677	Picture control
235-678	Sharpness control
235-683	3-position Color Sentry switch
235-682	Color, tint, black level preset control

The following part is included in your chroma/luminance module.

235-685	Chroma/luminance integrated circuit

The following part is included in your remote control transmitter.

969-423	6-volt "J" size battery

*The picture tube replacement kit contains the necessary optical coupling pad, picture tube, anode lead and connector, and instruction sheet for installation.

STEP-BY-STEP ASSEMBLY

Refer to Pictorial 2-1 for the following steps.

NOTES:

1. Before you begin to assemble your TV, place the cabinet in a room where you will have easy access to the front and back of the cabinet. Also, it will be helpful if the room is carpeted since you will position the cabinet face down on the floor later on.

2. Use the 1/4" end of the plastic nut starter to hold and start 6-32 nuts on screws. Then use the 1/4" nut driver to tighten the nuts securely.

( ) Remove the eighteen screws from the cabinet back and set them and the cabinet back aside.

( ) Face the front of the cabinet; then use your fingertips to carefully pry the three top screen frame clips from their cabinet sockets. Once the top clips are free, carefully pry the two side clips loose, lift the screen frame from the lower cabinet slot, and set it aside.

( ) Remove the two top and two side screen brackets from the cabinet and set them and their mounting screws aside. Make sure the screen does not fall out of the cabinet after you remove the last bracket.

( ) Hold the screen near the edges and lift it from the bottom rail of the cabinet. Set the screen aside in a safe area where it will not be in the way. Be very careful not to scratch its surface.

Refer to Pictorial 2-2 for the following steps.

( ) Position the control escutcheon as shown in the Pictorial.

( ) Press the door latch into the control escutcheon cutout until it snaps into place. You can install the catch either way.

( ) Position the slide switch assembly with the long tab as shown. Then mount this assembly to the escutcheon with two #4 × 5/16" phillips screws.

( ) Slide a round light shield over each of the four control assembly toggle switches until each shield is against the switch body.

( ) Locate the two wires w/eyelets and the push-on connector assembly.

( ) Mount the control assembly to the control escutcheon with two 8-10 × 1/2" hex-head screws. Also mount one of the wire assembly eyelets under the indicated screw. Route the wires as shown.

( ) Slide the two wires w/eyelets & push-on connector over the long lug on the slide switch assembly. Refer to the inset drawing to see how to install the push-on connector over the lug.

Refer to Pictorial 2-3 for the following steps.

NOTE: In the following steps, use care when you install the keyboard membrane switch. Once it is installed, it is impossible to remove without destroying it. Make sure you install it correctly the first time.

( ) Position the door as shown. Then remove and discard the backing from the keyboard membrane switch and very carefully align the left edge of the membrane switch with the left edge inside the recessed area of the door. Press the adhesive side of the keyboard membrane switch against the door from left-to-right until it is firmly in place.

( ) Install the adhesive side of the two 3/16" × 3/8" adhesive fiber washers onto the sides of the door so the holes align as shown.

( ) Insert the keyboard membrane switch ribbon cables through the slot at the top of the control escutcheon and install the door into the control escutcheon so the mounting holes align. Mount the door to the escutcheon with two 8-32 × 13/32″ setscrews until the ends are flush with the outside edge of the escutcheon.

( ) Install the door catch into the latch until it latches.

( ) Remove the backing from the catch and then close the door so it contacts the adhesive side of the catch. Open the door and press against the catch so the adhesive sticks firmly to the door.

( ) Close the door and it should latch in place. Press the door at the "push" location and it should unlatch.

( ) Align the flat of a knob with the flat of the Balance control shaft and press the knob onto the shaft as far as it will go.

( ) Similarly install the remaining knobs on the Bass and Treble control shafts.

Refer to Pictorial 2-4 for the following steps.

Refer to Detail 2-4A for the next three steps.

( ) 1. Refer to inset drawing #1 on Detail 2-4A and remove the indicated tab (if present) from the keyboard socket holder.

( ) 2. Position the keyboard socket holder with the slots as shown. Insert the slotted connector at the end of cables 6B6 and 6C6 into the wider of the two socket holder slots with the socket tab as shown in inset drawing #2 of Detail 2-4A.

( ) 3. Insert the slotted connector at the end of cable 6A6 into the remaining slot of the keyboard socket holder with the tab as shown in the Detail. Note that the socket wires are reversed from the previously installed socket wires.

( ) Install a 4″ cable tie around the 6A6, 6B6, and 6C6 cables and through the keyboard socket holder hole. Cut off the excess cable tie.

( ) Refer to Pictorial 2-4 and form the keyboard socket holder as shown. Mount the socket holder, the remaining eyelet coming from the two wires w/eyelets and push-on connector, and the keyboard membrane to control escutcheon hole A with an 8-10 × 1/2″ hex-head screw. Mount the eyelet between the escutcheon boss and the keyboard membrane as shown. NOTE: You may have to open the control escutcheon door to align the membrane mounting holes properly.

( ) Locate the wire w/eyelets and mount an eyelet between the keyboard socket holder and the keyboard membrane at hole B with an 8-10 x 1/2″ hex-head screw. You will install the other end of this wire later.

( ) Insert the wide and narrow keyboard membrane switch ribbon cables into the large and small slotted sockets as shown. Make sure the cables slide into the sockets as far as possible. Do not touch the cable connector contacts, or a poor connection could result.

Refer to Pictorial 2-5 for the following steps.

( ) Route the control assembly cables through the cabinet top opening and position the control escutcheon assembly with the catch facing toward the front of the cabinet. Install the assembly in the cabinet cutout.

( ) Loosely mount two control panel mounting brackets to the cabinet with four 8-18 × 1/2″ hex-head screws. NOTE: All of the cabinet mounting hole locations are predrilled.

( ) Loosely mount the control escutcheon to the control panel mounting brackets with four 8-10 × 1/2″ hex-head screws. Center the control assembly in the cabinet cutout and tighten the eight mounting screws securely.

( ) Route the cables coming from the control assembly through the mirror support cutout. Be very careful not to strike the mirror.

( ) Insert the rear of the control cover into the mirror support cutout and mount the cover to the cabinet with 8-18 × 1/2″ hex-head screws.

( ) If it has not already been done, close and latch the control panel door.

Refer to Detail 2-6A for the next four steps.

( ) 1. Mount the light sensor and stereo LED assembly over the infrared housing stud with a 1/8″ × 3/8″ adhesive fiber washer and a 1/4″ hex nut. Position the adhesive side of the washer toward the circuit board and the flat side of the nut towards the washer. The 1/4″ hex nut will self-thread over the stud. Once the assembly is secure, center the green stereo LED over its window opening, if necessary.

( ) 2. Remove the backing from the infrared window and press the window into the infrared housing assembly as shown.

( ) 3. If installed, remove the protective film from the lens of the infrared detector assembly. Make sure the inside of the infrared window is free of dust and finger prints and then mount it to the housing with two 6-20 × 1/4″ hex-head screws. Position the infrared assembly with the circuit board as shown.

( ) 4. Mount an 8″ cable tie around the infrared detector assembly and the light sensor and stereo LED assembly cable. Cut off the excess cable tie.

Refer to Pictorial 2-6 for the following steps.

( ) Loosely mount the infrared detector assembly to the inside of the cabinet at the window cutout with two 8-18 × 1/2″ hex-head screws. Center the assembly in the cutout and tighten the screws securely.

( ) Locate the cable with the black and violet wires and 2-hole female connector shell coming from the control assembly and separate it from the other cables. Then route the 2-wire cable to the infrared detector assembly and connect it to the male connector plug on the end of the black and violet cable. Route the cable as shown in the Pictorial.

( ) Locate the 6N9 cable assembly and the 6H9 cable assembly.

( ) Connect the 3-hole female connector shell on the end of the 6N9 cable assembly to the 3-hole male connector coming from the infrared detector assembly.

( ) Connect the slotted socket on the end of the 6H9 cable assembly over the edge of the circuit board on the infrared detector assembly. The socket will only fit on the circuit board one way.

( ) Route the ends of the 6N9 and 6H9 cable assemblies out the rear of the cabinet as shown in the Pictorial.

Refer to Detail 2-6B for the following steps.

NOTE: When you handle the speakers in the following steps, be careful not to damage the delicate paper cones.

( ) Place a towel or a soft cloth on top of your cabinet to protect it from scratches. Then position the two 2-1/2″ and two 6-1/2″ speakers cone-side down on the cloth as shown in the Detail. Position the speakers with the terminals and identification marks as shown.

Locate the brown wires w/push-on connectors and note that two of the four push-on connectors have one or two wires with marks on them. These marks can be either white lettering or a white stripe. You will connect this brown wire assembly to the **left** set of speakers in the following steps.

( ) Slide the push-on connector with the two marked wires over the 6- 1/2″ speaker terminal with the identification (ID) mark near it.

( ) Slide the push-on connector with the two unmarked wires over the other 6-1/2″ speaker terminal.

( ) Slide the push-on connector with the one marked wire over the 2- 1/2″ speaker terminal with the identification (ID) mark near it.

( ) Slide the push-on connector with the one unmarked wire over the 2- 1/2″ speaker terminal that has no capacitor connected to it.

Locate the red wires w/push-on connectors and connect them to the **right** set of speakers as follows:

( ) Slide the push-on connector with the two marked wires over the 2- 1/2″ speaker terminal with the identification (ID) mark near it.

( ) Slide the push-on connector with the two unmarked wires over the other 2-1/2″ speaker terminal.

( ) Slide the push-on connector with the one marked wire over the 6- 1/2″ speaker terminal with the identification (ID) mark near it.

( ) Slide the push-on connector with the one unmarked wire over the other 6-1/2″ speaker terminal.

NOTE: When you mount the speakers to the cabinet studs in the next steps, be careful not to puncture the cones. Also, be careful not to disturb the CRT assembly.

Refer to Pictorial 2-6 for the following steps.

( ) Position the left set of speakers (with the brown wires) so their terminals are positioned as shown in Pictorial 2-6. Then install them over their left cabinet studs. Secure the speakers to the cabinet studs with six 5/16″ hex nuts. Use the 5/16″ end of the 1/4″ × 5/16″ wrench supplied with your kit to tighten the nuts.

( ) Similarly mount the right set of speakers to their right cabinet studs. Make sure you position the speakers with the terminals as shown in the Pictorial.

( ) Route the right speaker wires along the front of the cabinet and under the CRT assembly to the left speaker wires. Then route both sets of wires toward the rear of the cabinet.

Refer to Pictorial 2-7 for the following steps.

( ) Cut the following lengths of 1″ wide foam tape:

Two 2-1/2″
Two 6-1/2″
One 22-3/4″
Two 7-1/2″

NOTE: Whenever you install a length of foam tape or gasket, use the following procedure:

1. Make sure the area on which you wish to apply the foam tape or gasket is clean of dust and dirt.

2. Use the indicated length of foam tape or gasket called out in the step and place it along the area you wish to apply it to.

3. Once the foam tape or gasket is centered, lightly mark the surface at either end as a reference.

4. For very long lengths, remove a short section of the adhesive backing from the foam tape or gasket and press the adhesive side onto the surface so the end is even with the pencil mark you made. Continue to press the adhesive side of the tape onto the surface, removing the backing as you go for very long lengths, until the entire length is in place. Be careful. Once you install foam tape or gasket, it is almost impossible to remove without destroying it.

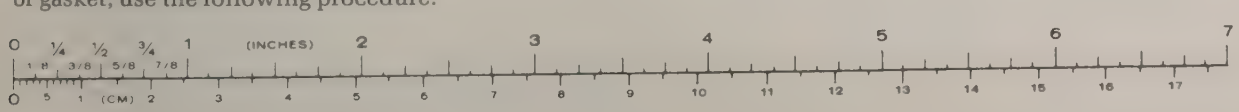
Refer to Detail 2-7A for the following three steps.

( ) 1. Position the left light shield with the shiny side up as shown. Then apply a 2-1/2″ and a 7-1/2″ piece of 1″ wide foam tape at the indicated locations.

( ) 2. Similarly, position the right light shield as shown and apply a 2-1/2″ and a 7-1/2″ piece of 1″ wide foam tape at the indicated locations.

( ) 3. Similarly, position the top light shield as shown and apply two 6-1/2″ and one 22-3/4″ pieces of 1″ wide foam tape at the indicated locations.

( ) Mount the left light shield (shiny side down) to the cabinet and the CRT assembly with 8-18 × 5/8″ hex- head screws. Mount the center screws first and the top left corner screw next. Do not install a screw in the top right corner. Keep the speaker wires in front of the shield. The holes in the cabinet are not predrilled.



( ) Mount the right light shield (shiny side down) to the cabinet and the CRT assembly with 8-18 × 5/8″ hex-head screws. Mount the center screws first and the top corner screw next. Do not install a top left corner screw yet. Keep the infrared detector cables on top of the cabinet support and under the shield with just enough slack so they do not stress the assembly.

( ) Install a beaded cable tie through holes C and D in the top light shield with the keyhole end as shown. You will secure the cable tie later.

( ) Similarly install a beaded cable tie through holes E and F.

( ) Mount the top light shield (shiny side down) to the cabinet with 8-18 × 5/8″ hex-head screws.

Refer back to Pictorial 2-1 for the following steps.

( ) Remove the three plastic covers from the lenses and discard them.

( ) At this time, check the mirror and the three CRT lenses inside the cabinet for dust and dirt. If necessary, refer to the "General Maintenance" instructions on Page 82 and clean the cabinet mirror and CRT lenses. Also use the instructions in this section to clean the screen, if necessary.

( ) Carefully position the top of the screen up with the grooved side facing you and install the bottom edge of the screen into the cabinet rail. Be careful not to tear the gasket when you install the screen into the rail. Then, center the screen into the front cabinet frame and reinstall the four screen brackets with the mounting hardware you removed earlier. Install the top brackets first.

NOTE: When you install the following labels, remove the backing from each one before you install it.

( ) Install the Heath nameplate in its front cabinet cutout.

( ) Install the screw removal label at the indicated cabinet front location.

( ) Install the bottom lip of the screen frame into the cabinet slot and snap the five frame clips into their cabinet sockets.

Refer to Pictorial 2-8 for the following steps.

( ) Position the cabinet with the back facing you.

( ) Drape the control and infrared assembly cables (except the black and violet 2-wire cable which you connected earlier) over the top of the cabinet so you do not step on the connectors during the following assembly.

( ) Press twelve wire tie standoffs into the indicated top shelf holes. Position each tie as shown.

( ) Route the black and violet 2-wire cable coming from the infrared assembly through the indicated wire tie standoffs.

NOTE: You will install the module assembly mounting brackets in the following steps. When you mount each bracket, position it as shown in the Pictorial. Generally, you will be working in a left to right, top to bottom sequence.

( ) Mount a module frame at BA with three 8-18 × 5/8″ hex-head screws.

( ) Mount another module frame and an RF shield at BB with with three 8-18 × 5/8″ hex-head screws. Position the RF shield under the frame with the tab as shown.

( ) Press a square standoff into the indicated hole of a stereo IF mounting bracket.

( ) Mount the stereo IF mounting bracket at BC with two 8-18 × 1/2″ hex-head screws.

( ) Mount a tuner support bracket to studs BD and BE with two 11/32″ hex nuts w/lockwashers. Use the 11/32″ end of the open end wrench supplied with the kit to tighten these nuts.

( ) Press a square standoff into the indicated hole of the second stereo IF mounting bracket.

( ) Mount the stereo IF mounting bracket and the stereo IF insulator at BF with two 8-18 × 1/2″ hex-head screws. Place the insulator on top of the bracket.

( ) Mount the stereo interface mounting bracket at BG with a 8-18 × 1/2″ hex-head screw.

( ) Mount a video IF mounting bracket at BH with three 8-18 × 1/2″ hex-head screws.

( ) Slide the remaining RF shield over studs BK and BL. Then press a round standoff into hole BN. Use the 1/4″ nut driver to press the standoff fully into the hole.

Refer to Detail 2-8A for the following steps.

( ) Position the antenna terminal bracket as shown.

( ) Press the round plug into the large round hole of the antenna terminal bracket.

( ) Mount the coaxial connector to the antenna terminal bracket with a 3/8″ hex nut.

( ) Mount the round 3-hole socket to the antenna terminal bracket with two M2.6 × 10 mm phillips screws. Position the socket with the lugs as shown in the inset drawing.

( ) Locate cable 6O9.

Connect the free ends of the wires of cable 6O9 to the round 3-hole socket as follows. Solder each wire to the lug after you connect it and cut off the excess wire lengths.

( ) Violet wire to lug 1.

( ) White wire to lug 2.

( ) Yellow wire to lug 3.

( ) Refer to Pictorial 2-8 and mount the antenna terminal bracket assembly over studs BP and BQ with two 11/32″ hex nuts w/lockwashers. Route the wires and cables out the bottom as shown.

Refer to Detail 2-8B for the following steps.

NOTE: In the following steps, (NS) means not to solder because other wires will be added later. "S-" with a number following it, such as (S-3), means to solder the connection. The number "3" tells you that there are three wires and/or leads at the connection.

( ) Position the audio/video bracket as shown.

( ) R1: Connect one lead of a 2200 Ω (red-red-red) resistor to SW1 lug 1 (NS) and the other lead to lug 3 (NS).

( ) R2: Connect one lead of the other 2200 Ω (red-red-red) resistor to SW1 lug 4 (NS) and the other lead to lug 6 (NS).

( ) R3: Connect one lead of a 75 Ω (viol-grn-blk) resistor to S10 lug 1 (NS) and the other lead to lug 2 (S-1).

Locate the 6″ white wire you set aside earlier and prepare the following wires:

( ) Two 1-1/2″
( ) One 2″

( ) Discard the remaining white wire.

( ) Connect one end of a 1-1/2″ white wire to S5 lug 2 (NS) and the other end to S7 lug 2 (S-1).

( ) Connect one end of another 1-1/2″ white wire to S6 lug 2 (NS) and the other end to S8 lug 2 (S-1).

( ) Connect one end of the 2″ white wire to S9 lug 2 (S-1) and the other end to S10 lug 3 (NS).

( ) Route the wires as shown.

Locate the following cable assemblies:

( ) 8J4.
( ) 8B4.
( ) 2A.
( ) 4B4.
( ) 4E9.

NOTE: The cable assemblies with two shielded cables that you will connect in the next steps, have one cable with a marked center lead (e.g. colored stripe) and one with an unmarked center lead. Make sure you connect the correct leads.

Connect the two 4B4 shielded cables to the audio/video panel as follows:

( ) Unmarked center lead to S3 lug 2 (S-1) and its shield lead to lug 1 (S-1).

( ) Marked center lead to S4 lug 2 (S-1) and its shield lead to lug 1 (S-1).

Connect the two 4E9 shielded cables to the audio/video panel assembly as follows:

( ) Unmarked center lead to S5 lug 2 (S-2) and its shield to lug 1 (S- 1).

( ) Marked center lead to S6 lug 2 (S-2) and its shield to lug 1 (S- 1).

( ) Cut a 3/8″ length of fiber sleeving.

( ) Slide the 3/8″ length of fiber sleeving over the shield lead on cable assembly 2A.

Connect the 2A shielded cable to the audio/video panel assembly as follows:

( ) Center lead to S10 lug 3 (S-2) and its shield to lug 1 (S-2).

Connect the 8B4 cable assembly to the audio/video panel assembly as follows:

( ) Marked red wire (with stripe or lettering) to SW1 lug 2 (S-1).

( ) Unmarked red wire to S1 lug 1 (NS).

Connect the 8J4 cable assembly to the audio/video panel assembly as follows:

( ) Marked brown wire (with stripe or lettering) to SW1 lug 5 (S-1).

( ) Unmarked brown wire to S2 lug 1 (NS).

( ) Cut four 1/2″ pieces of fiber sleeving.

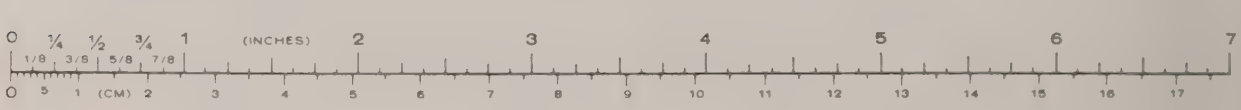
NOTE: When you mount the next two resistors, position them as shown in the inset drawing on Detail 2-8B.

( ) Slide a 1/2″ piece of fiber sleeving over the leads of the two 2.2 Ω, 5%, 3-watt wire-wound resistors.

( ) R4: Connect one lead of a prepared 2.2 Ω wire-wound resistor to S1 lug 2 (S-1) and the other lead to SW1 lug 1 (S-2).

( ) R5: Connect one lead of the other prepared 2.2 Ω wire-wound resistor to S2 lug 2 (S-1) and the other lead to SW1 lug 6 (S-2).

( ) Place the audio/video panel assembly on the bottom of the cabinet with the component side facing you.



Connect the red wires coming from the right speakers to the audio/video panel bracket assembly as follows:

( ) Marked red wire to SW1 lug 3 (S-2).

( ) Unmarked red wire to S1 lug 1 (S-2).

Connect the brown wires coming from the left speakers to the audio/video panel assembly as follows:

( ) Marked brown wire to SW1 lug 4 (S-2).

( ) Unmarked brown wire to S2 lug 1 (S-2).

( ) Recheck each wire and cable connection on the audio/video panel assembly to make sure that they are are soldered properly and that none of the connections have bare wires that could short together.

( ) Route the cable assemblies as shown in Detail 2-8B and install 4" cable ties around them at panel holes BR and BS. Cut off the excess cable ties.

( ) Refer to Pictorial 2-8 and mount the audio/video panel assembly to studs BT and BU with two 11/32" hex nuts w/lockwashers. You will connect the cables coming from this assembly later.

( ) Mount the crosshatch mounting bracket over stud BP with an 11/32" hex nut w/lockwasher. Keep the two brackets against each other.

( ) Remove the backing from the foot and press the foot over the hole in the crosshatch mounting bracket.

Refer to Pictorial 2-9 for the following steps.

NOTE: You will mount the module assemblies to their brackets in the following steps. Make sure you position each module as shown in the Pictorial before you mount it.

( ) Using the arrows as a guide, mount the tuner control module to its mounting frame. Insert the indicated edge of the module under the three tabs so the small square tab fits into the board hole. Then lower the other side of the module onto the two right flexible tabs. Pry each of these tabs out (use a flat-bladed screwdriver, if necessary) until they snap over the edge of the module.

( ) Mount the stereo decoder module to its mounting frame as in the previous step using the arrows as a guide.

( ) Insert the audio & video isolation module tabs into the slots of its mounting bracket. Secure the module to the square standoff with an 8-10 × 5/8" hex-head screw.

( ) Mount the tuner and tuner module to its support bracket with two 8-18 × 5/16" hex-head screws.

( ) Insert the stereo IF module tabs into the slots of its mounting bracket and secure the module to the square standoff with an 8-10 × 5/8" hex-head screw.

( ) Insert the stereo interface module tabs into its mounting bracket slots and secure the module with a 6-20 × 7/16" hex-head.

( ) Locate the stereo interface module.

( ) Refer to inset drawing #1 and cut four stakes from the strip as shown.

( ) Refer to inset drawing #2 and solder a stake onto the indicated lead of 10Ω, 3-watt resistor R10 as shown. You will slide a connector over this stake later. Set it aside for now.

( ) Slide the video IF module into its mounting bracket slots as shown by the arrows so it locks into place securely.

( ) Mount a large retaining bracket to the video IF module cabinet studs with two 11/32" hex nuts w/lockwashers.

( ) Mount the crosshatch circuit board assembly to its mounting bracket with two 4-40 × 1/4" phillips screws. Route the wires as shown.

( ) Mount the left amplifier mounting bracket (with the round and slotted holes) to the stereo amplifier module heat sink with an 8-18 × 1/2" hex-head screw. Keep the bracket perpendicular to the heat sink.

( ) Mount the right amplifier mounting bracket (with the round holes) to the stereo amplifier module with an 8-18 × 1/2" hex-head screw. Keep the bracket perpendicular to the heat sink.

( ) Install the stereo amplifier module brackets over its two cabinet studs and snap the tapered end of the round standoff into the module hole. Secure the module to the studs with two 11/32" hex nuts w/lockwashers.

Refer to Pictorial 2-10 for the following steps.

NOTE: In the following steps, you will mount parts on the lower half of the cabinet shelf. Be careful not to bump or drop anything on the CRT's.

( ) To make this part of the assembly easier, lay the cabinet assembly face-down on a carpeted floor, or, if you prefer, support the top of the cabinet against the cushions of a sofa or a large chair. Use whatever method is most convenient for you. However, make sure that the surface against which the cabinet is placed, is padded and free of objects that could scratch its finish. **Be very careful so that no objects press against the screen.** Do not jar the assembly when you lay it down. Since the cabinet is heavy, you may wish to have someone help you with this step.

( ) Press nine wire tie standoffs into their lower cabinet shelf holes at the indicated locations. Position the standoffs as shown.

( ) Mount one of the chroma/raster registration brackets at CA with three 8-18 × 1/2" hex-head screws. Note the location of the slots.

( ) Mount another chroma/raster registration bracket at CB with three 8-18 × 1/2" hex-head screws. The slots should be the same as the previous bracket.

( ) Mount the focus control mounting bracket to studs CC and CD with two 11/32" hex nuts w/ lockwashers.

( ) Mount the high voltage mounting bracket at CE with three 8-18 × 1/2" hex-head screws.

( ) Mount the switch mode power supply mounting bracket at studs CF and CG with 11/32" hex nuts w/lockwashers.

Refer to Pictorial 2-11 for the following steps.

( ) Position the chroma/luminance module as shown. You will mount stakes to components on this module in the following steps.

( ) Refer to inset drawing #1 and solder a stake to the indicated lead of resistor R2206 (brn-blk-org-gld) as shown. Make sure that you do not use more heat than necessary to make this connection and that the stake does not contact adjacent bare wire W5. Push the wire away from the stake, if necessary.

( ) Refer to inset drawing #2 and solder a stake to the bare wire at R2477. Keep this stake at the center of the bare wire.

( ) Discard the remaining extra stake.

( ) Mount the chroma/luminance module to its mounting bracket as shown by the arrow.

( ) Mount a small retaining bracket to the chroma/luminance module bracket with an 8-10 × 1/2" hex-head screw.

( ) Similarly mount the raster registration module to its mounting bracket as shown by the arrows.

( ) Mount a small retaining bracket to the raster registration module mounting bracket with an 8-10 × 1/2" hex-head screw. Make sure the bracket tab fits into the board hole.

( ) Snap the focus module onto the focus control assembly as shown. Be careful not to apply too much pressure to the board when you snap it over the tabs or you could crack the board.

( ) Install the red, green, and gray wire sockets over the center and two outside pins of plug 5R as shown in inset drawing #3.

( ) Mount the focus control assembly to its bracket with three 8-18 × 1-1/2″ hex-head screws. Be careful not to pinch any of the wires between the assembly and the bracket.

( ) Mount the sweep module to the sweep module mounting bracket.

( ) Mount a large retaining bracket to sweep module studs CH and CJ with two 11/32″ hex nuts w/lockwashers.

( ) Mount the switch mode power supply module to its mounting bracket. You will secure the module to its mounting bracket later.

( ) Similarly mount the two remaining centering magnet assemblies over the other two CRT necks.

( ) Slide the three video output module insulators over the CRT necks and position the tab as shown.

( ) Remove and discard the plastic pin connectors from the CRT plugs.

( ) Install the three video output modules onto the CRT sockets. Press the sockets onto the CRT pins as far as they will go. The end of the base should protrude approximately 3/16″ through the socket as shown in inset drawing #4. The sockets and CRT plugs are polarized to fit only one way.

( ) Mount the line cord bracket to the base of the cabinet with two 8-18 × 1/2″ hex-head screws. There are no pilot holes at these screw locations.

( ) Clamp the strain relief over the line cord approximately 21″ from connector 3R8 and mount the strain relief to the line cord bracket as shown in inset drawing #5. Make sure the AC plug end of the line cord faces the outside of the cabinet.

( ) Drape the cables and wiring from the CRT and module assemblies over the bottom of the cabinet so you can easily identify and connect them in the following steps.

Refer to Pictorial 2-12 for the following steps.

During most of the remaining assembly, you will be connecting cables between the various modules. Most of the cables are identified by a number/letter designation which matches the number/letter designation next to the module plug. Some of the number/letter designations that appear on a connector are different or missing on the module. In those cases, refer to the illustration for its location. All of the connectors are polarized to fit only one way.

Keep your wiring neat. When you route a cable between modules, install the cable into the wire tie standoffs shown by the heavy lines in the illustration. As the wire ties begin to fill with the various cable wires, simply twist the wire tie one turn to hold the wiring in place.

WARNING: In the following steps, do not touch the bare ends of the CRT high voltage anode connectors. Touch only the plastic fasteners. When you install an anode lead, push it all the way into the focus control assembly hole at the designated location; then twist the fastener 1/4 turn in the direction of the arrow to lock it in place as shown in the inset drawing.

Install the following anode connectors into the designated focus control assembly holes:

( ) Anode connector coming from the sweep module into hole 1.

( ) Anode connector coming from the blue CRT to hole 2.

( ) Anode connector coming from the green CRT to hole 3.

( ) Anode connector coming from the red CRT to hole 4.

( ) Install a medium wire tie around the four anode leads as shown.

( ) Loosely install an 8″ cable tie through the focus control assembly mounting bracket and around the four anode leads as shown.

Install the 2-hole sockets coming from the focus control assembly over the video output module plugs in the following steps. Press each socket onto its plug so the small tab locks into place inside the socket hole. **IMPORTANT: If you install a socket backwards on a CRT, the CRT will not work.**

( ) Socket with red mark to the red CRT module plug.

( ) Socket with the green mark to the green CRT module plug.

NOTE: The blue CRT is mounted upside down from the other two CRT's. Make sure you install the 2-hole socket on the video output module plug properly.

( ) Socket with no mark on it to the blue CRT module plug.

( ) Connect the eyelet on the end of the ground lead coming from the red focus control socket to CRT chassis hole DB with an 8-18 × 3/8″ hex-head screw w/lockwasher. Position the lug with the flat against the chassis as shown.

( ) Connect the eyelets on the ends of the ground leads coming from the green and blue focus control sockets and from the sweep module to CRT chassis hole DC with an 8-18 × 3/8″ hex-head screw w/lockwasher. Position the lugs with the flats against the chassis as shown.

( ) Insert a 4″ cable tie through focus control assembly hole DD. Then gather the focus leads coming from the focus control assembly into a bundle and wrap the cable tie around them.

( ) Route each of the focus leads coming from the 2-hole sockets through the hole in the video output module insulators.

( ) Hook medium wire ties through CRT chassis holes DE and DF.

Connect the yoke cable sockets coming from the red CRT to the raster registration module plugs in the following steps. **Make sure** you route the yoke cables **under** the CRT ground strap as shown, and then through CRT chassis wire tie DE as shown. Make sure you position the plugs with the tabs as shown.

( ) Connector 8D to plug RED 8D.

( ) Connector 8B to plug RED 8B.

Similarly connect the yoke cable sockets coming from the green CRT to the raster registration module plugs as follows. Make sure you route these cables under the CRT ground strap as shown.

( ) Connector 8D to plug GREEN 8D.

( ) Connector 8B to plug GREEN 8B.

Similarly connect the yoke cable sockets coming from the blue CRT to the raster registration module plugs as follows. Make sure you route these cables through cable ties DE and DF as shown.

( ) Connector 8D to plug BLUE 8D.

( ) Connector 8B to plug BLUE 8B.

( ) Twist wire ties DE and DF around the yoke cables one turn.

( ) Route the red and brown speaker wires coming from the audio/video bracket assembly through the indicated wire ties. Then form the wires into a small bundle and wrap a medium wire tie around them.

Refer to Pictorial 2-13 for the following steps.

( ) Install one connector on cable 5DR/2N to the red CRT video output module plug 5D, and install the other connector to chroma/luminance module plug 2N.

( ) Install connector 5B on the 5B/5H cable to the red CRT video output module plug 5B, and connector 5B/5H to focus control module plug 5H RED, as shown in the inset drawing.

( ) Install one connector on cable 5C to red CRT video output module plug 5C and the other connector to green CRT video output module plug 5C.

( ) Install one connector on the 5DG/2P cable to green CRT video output module plug 5D and the other connector to chroma/luminance module plug 2P.

( ) Install connector 5B on a 5B/5H cable to the green CRT video output module plug 5B and connector 5B/5H to focus module plug 5H Green.

( ) Install connector 5B on another 5B/5H cable to the blue CRT video output module plug 5B and connector 5B/5H to focus module plug 5H Blue.

( ) Install one connector on a 5C/5C cable to green CRT video output module plug 5CC and the other connector to blue CRT video output module plug 5CC.

( ) Install one connector on cable 2Q/5DB to blue CRT video output module plug 5D and the other connector to chroma/luminance module plug 2Q.

( ) Install connector 3B/5G on the 3B/5G cable to focus module plug 5G and connector 3B to sweep module plug 3B5.

( ) Install one connector on the 4H/5C cable to blue CRT video output module plug 5C and the other connector to sweep module plug 4H.

NOTE: There is no connector at plug 5CC on the red CRT video output module.

( ) Install a 4" cable tie through slot DG in the focus module and around a medium wire tie.

( ) Route and dress all the cables you have previously connected through wire tie DG as shown in the Pictorial. Remember to keep your wiring neat.

( ) Install a medium wire tie around the 5B/5H cables as shown.

Refer to Pictorial 2-14 (fold-in sheet) for the following steps.

( ) Install the red wire connector coming from the crosshatch circuit board over the stereo interface module resistor stake at R10.

Install the remaining wire connectors coming from the crosshatch circuit board to the chroma/luminance module as follows:

( ) Green wire connector over the stake on resistor R2206.

( ) Blue wire connector over the stake on bare wire R2477.

( ) Yellow wire connector over the stake under contol R2485. Position the connector slot as shown in the inset drawing.

( ) White wire connector over the Vert High stake.

( ) Black wire connector over the Vert GND stake.

Connect the cables coming from the audio/video bracket assembly in the following five steps:

( ) 1. Brown wire connector 8J4 to stereo amplifier plug 8J4.

( ) 2. Red wire connector 8B4 to stereo amplifier plug 8B4.

( ) 3. Connector 4B4 to stereo decoder module plug 4B4.

( ) 4. Connector 4E9 to stereo decoder module plug 4E9.

( ) 5. Connector 2A to audio/video isolation module plug 2A.

( ) Wrap a large wire tie around the audio/video isolation module standoff and the 2A cable as shown.

( ) Install connector 8G6 on the 8G6 cable to stereo amplifier module plug 8G6 and the push-on connector to the RF shield tab.

( ) Install connector 4A3 on the 4A3 cable connector to stereo decoder module plug 4A3 and the push-on connector to the RF shield tab.

( ) Install connector 6O9 coming from the antenna terminal bracket to tuner control module plug 6O9.

In the following steps, you will connect the cables coming from the control assembly. At this time, untangle the cables so they exit the assembly in reasonable order. Drape the cables over the top of the cabinet.

Connect the control assembly cables as follows. Remember to fold any excess cabling into a bundle and place it in a wire tie to keep your wiring neat:

( ) Connector 2D7 to chroma/luminance module plug 2D7.

( ) Connector 2E7 to chroma/luminance module plug 2E7.

( ) Connector 3I to sweep module plug 3I.

( ) Connector 4B7 to stereo decoder module plug 4B7.

( ) Connector 4D6 to stereo decoder module plug 4D6.

( ) Connector 1S to audio/video isolation module plug 1S.

Install the control assembly cable connectors to the tuner control module as follows:

( ) Connector 6A6 to plug 6A6.

( ) Connector 6B6 to plug 6B6.

( ) Connector 6D6 to plug 6D6.

( ) Connector 6C6 to plug 6C6.

( ) Connector 6F6 to plug 6F6.

( ) Install connector 6L1 on the 6L1/1J6 cable to tuner control module plug 6L1 and connector 1J6 to tuner module plug 1J6. You will install the remaining connectors coming from this cable in the next two steps.

( ) Install the 2-hole male connector coming from tuner control module connector 6L1 to the 2-hole female connector coming from the control assembly.

( ) Install the 2-hole female connector coming from tuner module connector 1J6 to the 2-hole male connector coming from the control assembly.

( ) Connect the eyelet on the black wire coming from the control assembly to tuner module bracket hole DH with an 8-18 × 3/8″ hex-head screw w/lockwasher. Position the flat side of the eyelet against the bracket and be careful not to pinch the wires coming from 1J6.

( ) Connect the eyelet on the wire w/eyelet and push-on connector to tuner module bracket hole DJ with an 8-18 × 3/8″ hex-head screw w/lockwasher. Connect the push-on connector on the other end of the wire to the spark gap tab on the switch mode power supply module. Position the flat side of the eyelet against the bracket.

( ) Install connector 3R8 on the end of the line cord to switch mode power supply module plug 3R8.

( ) Refer to the inset drawing and mount a small wire tie with a 4″ cable tie to switch mode power supply bracket hole DK.

( ) Wrap the small wire tie around the line cord and the wire coming from the spark gap assembly.

( ) Install one connector on the 6M1/1K6 cable to tuner control module plug 6M1 and the other connector to tuner module plug 1K6.

( ) Install connector 6I2 on the 6I2-2H cable to tuner control module plug 6I2 and connector 2H to chroma/luminance module plug 2H.

( ) Install connector 6Y2 and connector 6Q2 on the 6Y2-6Q2-2X cable to tuner control module plugs 6Y2 and 6Q2. Install connector 2X to chroma/luminance module plug 2X.

( ) Install connector 6P9 on the 4P6-6P9 cable to tuner control module plug 6P9 and connector 4P6 to switch mode power supply plug 4P6.

( ) Install connector 6K3 on the 6K3-3N-3F cable to tuner control module plug 6K3 and connectors 3N and 3F to sweep module plugs 3N and 3F6. Route the cable under the anode leads.

Refer to Pictorial 2-15 (fold-in sheet) for the following steps.

( ) Install connector 6H9 coming from the infrared detector assembly to tuner control module plug **6H6**.

( ) Install connector 6T9 on the 6T9-8O4-8E7 cable to tuner control module plug 6T9, connector 8O4 to stereo interface module plug 8O4, and connector 8E7 to stereo amplifier module plug 8E7.

( ) Install connector 6A9 on the 6A9-2W6 cable to tuner control module plug 6A9 and connector 2W6 to chroma/luminance module plug 2W6.

( ) Install connector 6W9 on the 6W9-4Q6 cable to tuner control module plug 6W9 and connector 4Q6 to stereo decoder module plugs 4Q6.

( ) Install connector 6Z9 on the 6Z9-4B6 cable to tuner control module plug 6Z9 and connector 4B6 to stereo decoder module plug 4B6.

( ) Connect the round connector plug coming from connector 4Q6 on the stereo decoder module to the round connector shell coming from connector 6Z9 on the tuner control module.

( ) Install one connector on the 4A6/6J4 cable to tuner control module plug 6J4 and the other connector to stereo decoder module plug 4A6.

( ) Install connector 6G4 on the 6G4-1F cable to tuner control module plug 6G4 and connector 1F to video IF module plug 1F.

( ) Install connector 6S9 on the 4S6-6S9 cable to tuner control module plug 6S9 and connector 4S6 to switch mode power supply module plug 4S6.

( ) Install connector 6R9 on the 4R9-6R9 cable to tuner control module plug 6R9 and connector 4R9 to switch mode power supply module plug **4R6**.

( ) Install connector 6N9 coming from the infrared detector assembly to tuner control module plug 6N9.

( ) Install the right-angle end of the 12-1/2″ shielded cable to the indicated tuner control module socket and the other end to the indicated tuner module socket.

( ) Install connector 4G3 on the 4G3-8F4 cable to stereo decoder module plug 4G3 and the 1-hole connector coming from connector 4G3 over the indicated stake. Install connector 8F4 on the other end of the cable to stereo amplifier module plug 8F4.

( ) Install connector 4A1 on the 4A1-8N6 cable to stereo decoder module plug **4A1** (do not confuse connector 4A1 with connector 4A on the stereo decoder module) and connector 8N6 to stereo interface module plug 8N6.

( ) Install connector 4D1 on the 1D4-4D1 cable to stereo decoder module plug 4D1 and connector 1D4 to stereo IF module plug 1D4.

( ) Install connector 1Q3 on the 1Q3-3J cable to audio/video isolation module plug 1Q3 and connector 3J to sweep module plug 3J.

( ) Install one end of a 16″ shielded cable to audio/video isolation module connector J2 and the other end to stereo IF module connector J1202. Make sure you push the connector all the way on until it clicks.

( ) Install one end of a 30″ shielded cable to audio/video isolation module connector J1 and the other end to tuner module connector J1.

( ) Install connector 1A on the 1A-3M cable to video IF module plug 1A and connector 3M to sweep module plug 3M.

( ) Install connector 1B on the 1B-2C cable to video IF module plug 1B and connector 2C to chroma/luminance module plug 2C.

( ) Install one end of a 16″ shielded cable to video IF module connector IF Input and the other end to stereo IF module connector J1201.

( ) Install connector 1A4 on the 1A4-8A4 cable to stereo IF module plug 1A4 and connector 8A4 to stereo interface module plug 8A4.

( ) Install connector 1C9 on the 1C9-3H cable to stereo IF module plug 1C9 and connector 3H to sweep module plug 3H.

( ) Install connector 8O3 on the 8O3-3R cable to stereo interface module plug 8O3 and connector 3R to sweep module plug 3R.

( ) Install one end of the 8″ shielded cable to the coaxial socket on the antenna terminal bracket. Connect the other end of the cable to the tuner connector socket on the tuner module.

( ) Install connector 8C on the 3D-8C cable to raster registration module plug 8C and connector 3D to sweep module plug 3D8.

( ) Install connector 8A on the 3A-8A cable to raster registration module plug 8A and connector 3A to sweep module plug 3A.

( ) Install connector 2F on the 2F-3C cable to chroma/luminance module plug 2F and connector 3C to sweep module plug 3C2.

( ) Install one connector on the 2G/8H cable to chroma/luminance module plug 2G8 and the other connector to raster registration module plug 8H.

( ) Install connector 2A on the 2A-4K cable to chroma/luminance module plug 2A4 and connector 4K to sweep module plug 4K.

( ) Install one connector on the 4P8/8P4 cable to switch mode power supply module plug 4P8 and connector 8P4 to stereo amplifier module plug 8P.

( ) Install one connector on the 4G3/3G4 cable to switch mode power supply module plug 4G3 and connector 3G4 to sweep module plug 3G4.

( ) Install connector 3E4 on the 3E4-4E3 cable to sweep module plug 3E4 and connector 4E3 to switch mode power supply module plug 4E3.

( ) Install connector 3S on the 3S-4J8 cable to sweep module plug 3S and connector 4J8 to audio/video isolation module plug 4J8.

( ) Dress and route the wiring neatly against the cabinet. Check all of the wire tie standoffs and twist any that are open around the wires. Then **use the remaining wire ties** in your kit to further hold the high concentrated wiring areas together. Keep the wiring clear of the viewing port.

Refer to Pictorial 2-16 for the following steps.

( ) Press a standoff w/ears into each of the two holes in the switch mode power supply module heat sink as shown.

( ) Mount the remaining small retaining bracket and the end of the insulator to the switch mode power supply mounting bracket with an 8-10 × 1/2″ hex-head screw.

( ) Form the insulating paper over the switch mode power supply heat sink and route the line cord and spark gap wire out the corner cutout as shown.

( ) Snap the switch mode power supply insulator onto the standoff clips on the switch mode power supply heat sink.

( ) Remove the backing from the general fuse replacement label and press the label onto the switch mode power supply insulator at the indicated location.

( ) Similarly install the shock hazard warning label onto the switch mode power supply insulator at the indicated location.

NOTE: Clean any dust from the bottom of the cabinet at the areas where you will apply the following labels. Then apply the following labels to the cabinet bottom.

( ) CRT caution label.

( ) X-ray warning label.

Refer to Pictorial 2-17 for the following steps.

( ) Locate the 8" black wire you set aside earlier and prepare both ends.

( ) Form a hook in the one end of the prepared black wire and another in one lead of the remaining 11 kΩ (brn-brn-org-gld) resistor. Crimp and solder the hooked ends together.

( ) Crimp and solder a spring connector on the other lead of the 11 kΩ resistor.

( ) Insert the spring connector on the end of the 11 kΩ resistor into the remaining 1-hole connector until it snaps into place.

You will use this resistor assembly to test your TV Set later on. Set the test resistor aside for now.

This completes the TV assembly.

CONTROL PRESETS

Refer to Pictorial 3-1 (fold-in sheet) for the following steps.

( ) Adjust the centering magnet tabs together on each of the three CRT deflection yokes.

( ) Refer to Detail 3-1A and cut off the indicated end of the alignment tool.

( ) On the focus control module, use the large end of the alignment tool to turn the three Focus controls to their center of rotation.

( ) If they are not already there, plug the three jumper sockets on the focus control module at 5P, 5M, and 5K onto the LOW pins.

( ) Set focus control module switch SW5301 to NORMAL.

( ) Adjust focus control module G2 controls R5301 (red), R5304 (green), and R5307 (blue) fully counterclockwise.

Set the raster registration module controls as follows:

( ) Vertical Centering controls R8501, R8508, and R8514 to center.

( ) Horizontal Centering (HOR CENT) controls R8541 (red), R8529 (green), and R8526 (blue) fully counterclockwise.

( ) Horizontal Linearity controls RX8571 (red), RX8562 (green), and RX8561 (blue) fully counterclockwise.

( ) Vertical Linearity controls R8553 (red), R8513 (green), and R8557 (blue) fully counterclockwise.

( ) Height controls R8551 (red) and R8517 (blue) to center. NOTE: There is no height control for the green raster.

( ) If they are not already there, install the jumper sockets over the indicated STORE pins on the raster registration module.

( ) Turn chroma/luminance module Gain controls R2738, R2732, and R2727 fully clockwise.

( ) Set crosshatch circuit board switch SW901 to NORMAL.

( ) Facing the control knob, rotate crosshatch circuit board control R911 fully clockwise.

( ) Set the Speakers/Hi-Fi switch on the audio/video panel to INT.

On the cabinet top control panel, open the door and set the switches and controls as follows:

( ) COLOR SENTRY switch to OFF.

( ) PICTURE control to center.

( ) BLACK LEVEL control to center (detent).

( ) COLOR LEVEL control fully counterclockwise.

( ) TINT control to center.

( ) SHARPNESS control to center (detent).

( ) BASS, TREBLE, and BALANCE controls to center (0).

( ) EXTENDED STEREO switch to OFF.

( ) STEREO SOURCE switch to TV.

( ) VIDEO SOURCE switch to TV.

( ) AFC switch to NORMAL.

( ) BAND switch to VHF/UHF.

( ) If you have a 75 Ω antenna lead-in system, connect the antenna lead-in directly to the VHF/UHF/CATV (75Ω) antenna connector on the antenna terminal bracket as shown in Part 1 of Detail 3-1B. If you have a 300 Ω VHF/UHF lead-in system, connect the antenna balun to the 75 Ω antenna connector as shown in Part 2 of Detail 3-1B. Then connect the lead-in wire(s) to the terminals. (Refer to "Antennas" on Page 48 if necessary.)

NOTE: The remaining controls will be adjusted later.

Leave the cabinet in its face-down position for the following "Adjustments and Alignment."

ADJUSTMENTS AND ALIGNMENT

NORMAL OPERATING CHARACTERISTICS

When you first turn the TV Set on, and for several days later, you may hear occasional snapping (arcing). This arcing is normal, and may sometimes be quite loud. The arcing occurs between the elements of the picture tubes during its initial aging process. This arcing may occasionally be strong enough to turn the Set off. If this happens, simply push the POWER keypad to turn the TV Set back on.

The TV Set may make a sizzling sound when you turn it on or off. This is normal and is caused by the picture tube charging and discharging.

Refer to Pictorial 3-1 (fold-in sheet) for the following steps.

CRT FOCUS ADJUSTMENTS

WARNING: Extremely high voltage (30,000 volts) is present on the sweep module. Be very careful that you do not touch any of these module parts while the TV Set is in operation. A safe rule to remember when you work around high voltage is to use only one hand to work on the circuit and keep the other hand behind you. This helps prevent your body from becoming part of an electrical circuit from high voltage to ground.

If any sign of malfunctioning appears in the following steps, turn the Set off and disconnect the line cord from the wall outlet. Then refer to the "In Case Of Difficulty" section on Page 68. Do not operate the Set until you have located and corrected the problem, since prolonged operation of a malfunctioning TV Set could result in damaged integrated circuits, transistors, picture tubes, or other components.

NOTE: When you converge the three color CRT's in this section, the surface under the screen should be a plain, nonreflective black. This way, the light from the CRT's cannot reflect against a colored or patterned surface, and interfere with the CRT colors. If possible, slide a plain dark blanket, or something similar, under the TV screen at this time.

1. Plug the line cord into a 120 VAC wall outlet and press the TV Set POWER keypad to turn it on. The screen, as viewed through the viewing port, may or may not have light on it and there may or may not be sound present. Do not attempt to tune in a station at this time. Due to the warm-up time for the picture tubes, you may or may not see the channel number and time display in the lower right-hand corner of the screen. This display will be on for only a few moments and then turn off. If it is visible, the time display will be all zeros.

2. Use the keyboard to select a station with a strong signal in your area. For example, push 2, 8, and ENTER, and channel 28 will be selected.

3. Adjust the PICTURE control to be sure that you have a moderately bright picture. The picture may or may not fill the screen at this time. Leave the control at this setting.

4. Set the SETUP switch on the focus control module switch to SET-UP. Under no circumstances turn the TV set off with the switch in the SETUP position. To do so will permanently damage the picture tube.

CAUTION: The horizontal output transistor and the metal bracket under the switch mode power supply insulator has voltage on it. Do not touch either of these during the alignment.

5. Advance the Red, Green, and Blue G2 controls on the focus control module clockwise until the light output from each CRT is visible over the **entire** screen. You may have to adjust each control back and forth several times until you can determine where the light is just visible. Adjust the colors for a dim gray raster (light on the screen). NOTE: If a G2 control does not have enough range to turn the CRT completely off or to light the screen sufficiently:

    1. Set the SETUP switch to NORMAL.

    2. Turn the Set off.

    3. Move the jumper socket for that control to the MED or HIGH plug position.

    4. Turn the power back on, set the SETUP switch to SETUP, and readjust the control as indicated. Make sure the TV Set is still tuned to a strong station.

6. Set the SETUP switch on the focus control Module to NORMAL.

7. Adjust the PICTURE, and/or the BLACK LEVEL control so that you can just see the images on the screen. View the screen through the side opening in the top shelf for this step.

8. Check the tint of the picture's whitest areas. If these whites have a color tint, it means that one or two of the colors are of unequal intensity. Adjust the G2 control for the color(s) that are deficient in the raster. If the raster is predominantly magenta, the Red and Blue controls are advanced too far. If the raster is green, the Green control is advanced too far, etc. Adjust no more than two of the G2 controls.

9. Set the BLACK LEVEL control to its center (detent) position and adjust the PICTURE control for a picture of normal brightness. Note the tint of the whitest parts of the picture. If the picture is not black and white, adjust the Gain Output control(s) (R2727, R2732, R2738) on the chroma/luminance module to bring up the missing color(s) for the best possible black and white picture.

10. Set the Crosshatch circuit board switch to CROSSHATCH. Then view the screen through the side opening in the cabinet and adjust the PICTURE and BLACK LEVEL controls for the darkest background and the brightest red, green, and blue color lines on the screen. You will use these lines to focus the CRT lenses in the following steps.

11. Adjust the three Focus controls on the focus control assembly for the sharpest lines possible at the center portion of the screen. One or two of these controls may not seem to change the focus much. This is only a coarse adjustment. You will fine tune them later.

NOTE: In the following steps you will adjust the projection lenses for the best focus possible. This procedure will be a bit more difficult than normal, so take your time. You will be placing your hand under the top center light shield to adjust the color lenses. Do not be concerned about working around the high voltage leads during these adjustments. The CRTs and wiring (including the red anode leads) are fully insulated for your protection. When you place your hand near the CRT, you may experience a faint snapping or hissing, which is simply static buildup and is not dangerous.

12. Insert your hand under the top light shield and locate the wing nut for the red projection lens. (You can see the lenses through the side openings in top cabinet shelf.) Loosen the wing nut several turns and grip the tab of the slotted focus band. Slide the band in both directions several times until you obtain the sharpest red line possible at the center area of the screen. Then tighten the wing nut.

13. Similarly adjust the green projection lens focus for the sharpest green line at the center area of the screen.

14. Similarly adjust the blue projection lens focus for the sharpest blue line at the center area of the screen.

15. Readjust the three focus controls on the focus control assembly for the sharpest possible lines.

16. Turn off the power to the TV Set.

17. Insert the pointed end of a beaded cable tie that is installed on the top light shield through the CRT chassis hole. Then route the pointed end back through the larger hole in the keyhole slot at the other end of the cable tie and pull it tight. Pull the cable tie into the smaller hole of the keyhole slot to lock it in place.

18. Similarly secure the other beaded cable tie in the center light shield to the CRT chassis.

STATIC CONVERGENCE

1. Adjust the BLACK LEVEL control fully clockwise and the PICTURE control fully counterclockwise for the blackest background and the brightest colored crosshatch lines.

2. Adjust the chroma/luminance module Vertical Size control (R2126) so the top and bottom of the crosshatch pattern just fills the screen. NOTE: The picture may overlap more at the top or bottom of the screen. You will compensate for this later.

3. Check the outermost crosshatch pattern lines and make sure that all three color lines are parallel with each other and with the screen frame. (The lines do not have to be equally spaced.) If any color lines are not parallel, loosen the misaligned CRT yoke clamp and rotate the yoke until it is properly aligned with the other lines, then retighten the yoke clamp.

4. Center the green crosshatch pattern on the screen with the green centering magnets.

5. Adjust the red and blue centering magnets to align the red and blue crosshatch lines with the green lines. This will make white lines at the **center** of the screen. You will converge the outer lines later.

6. If necessary, readjust Vertical Size control R2126 to fill the screen. The picture may overlap more at the top or bottom of the screen. You will compensate for this later.

This completes the "Static Convergence."

DYNAMIC CONVERGENCE

CAUTION: DO NOT DISCONNECT connectors at 2N, 2P,and 2Q at the same time. If all three connectors become disconnected, turn the AC power off immediately; then wait a short while and reconnect the connector and turn the TV set back on. Failure to do so will cause CRT damage.

When you disconnect a connector, rock it from side-to-side while you pull upward. DO NOT rock the connectors from front-to-back.

1. Disconnect chroma/luminance module connectors 2N and 2Q.*

2. Adjust Green Horizontal Centering control R8529 on the raster registration module for the same amount of overscan (portion of the picture which is outside of the screen area) at the left and right sides of the picture.

3. Adjust the Green Vertical Centering control R8508 on the raster registration module for the same amount of overscan at the top and bottom of the picture. If the squares are stretched (non-linear) more at the top or bottom, refer to Detail 3-1C and remove the GREEN LINEARITY jumper socket from its STORE position on the raster registration module. Then place the socket over the appropriate linearity pins with the tab positioned properly to compensate for the stretched pattern. If the pattern is longer at the top than at the bottom, place the socket over the four TOP pins. If the bottom is longer, rotate the socket 90° and place it over the four bottom (BOT) pins.

NOTE: The **linearity** controls will not operate with the linearity jumper sockets in the STORE position. If you did not have to move the GREEN LINEARITY jumper socket from its STORE position, do not perform steps 4 and 5.

4. Adjust the raster registration module's Green Vertical Linearity control R8513 for the straightest lines at the bottom of the screen. NOTE: If you adjust the Linearity control too far in one direction, the pattern will "fold-over" abruptly. Do not adjust the control for this condition.

5. Readjust the raster registration module's Green Vertical Centering control (R8508) to obtain approximately the same overscan at the top and bottom of the picture.

6. Adjust Green Width coil LX8576 so that approximately one inch of overscan occurs on each side of the picture.

7. Reconnect chroma/luminance connector 2N.

8. Alternately adjust Red Horizontal Centering control R8541 and Red Vertical Centering control R8501 on the raster registration module to center the red crosshatch pattern over the green pattern at the center of the screen. Do not try to converge the outer lines.

9. Adjust Red Height control R8551 on the raster registration module to converge the red and green lines at the top of the screen. If the lines at the top and bottom of the screen are converged, proceed to step 12. However:

   If the red lines overscan more at the top of the picture than at the bottom, refer to Detail 3-1C and move the RED LINEARITY jumper socket from the STORE position to the TOP position. If more of a bottom overscan condition exists, move the RED LINEARITY jumper socket from the STORE position to the BOT position.

* Turn TV set off before disconnecting or reconnecting connectors.

10. If the LINEARITY jumper is at the TOP position, adjust Red Vertical Linearity control R8553 on the raster registration module to reconverge the lines at the top of the screen. If the LINEARITY jumper is at the BOT position, adjust R8553 to reconverge the lines at the bottom of the screen . All of the lines should be yellow when properly converged (one over the other).

11. If necessary, readjust the Red Vertical Centering control (R8501 on the raster registration module) to reconverge the lines at the top of the screen.

12. Adjust Red Width coil LX8577 so that the red and green lines are converged as close as possible at the right and left sides of the screen. You will fine tune this adjustment later.

NOTE: Check to see if you have yellow lines over the entire screen. If the red and green center lines have moved out of convergence, carefully readjust the red CRT centering magnets to converge them. Then repeat steps 10 (if applicable), 11, and 12 as many times as necessary to reconverge the top, bottom and side lines. If the exact convergence cannot be maintained, adjust the controls and coil for the best possible compromise. You will fine tune this convergence later.

13. Reconnect chroma/luminance connector 2Q and unplug connector 2N.

14. Adjust Blue Horizontal Centering control R8526 on the raster registration module to align the blue and green lines at the center of the screen.

15. Adjust Blue Height control R8517 on the raster registration module to converge with the green lines at the top of the screen. If the lines at the top and bottom of the screen are converged (one over the other), proceed to step 17. However:

    If the blue lines overscan more at the top of the picture than at the bottom, refer to Detail 3-1C and move the BLUE LINEARITY jumper socket from the STORE position to the TOP position. If more of a bottom overscan condition exists, move the BLUE LINEARITY jumper socket from the STORE position to the BOT position.

16. If the LINEARITY jumper is at the TOP position, adjust Blue Vertical Linearity control R8557 on the raster registration module to reconverge the lines at the top of the screen. If the LINEARITY jumper is at the BOT position, adjust R8557 to reconverge the lines at the bottom of the screen.

17. If necessary, readjust the Blue Vertical Centering control (R8514 on the raster registration module) to reconverge the lines at the top of the screen.

18. Adjust Blue Width coil LX8575 on the raster registration module so that the blue crosshatch lines at the right and left sides are converged with the green lines. If exact convergence cannot be maintained, adjust the coil for the best possible convergence. You will fine tune this adjustment later.

19. Reconnect chroma/lumininces connector 2N.

NOTE: The lines should now be white over the entire screen. If any of the color vertical or horizontal center lines have moved out of convergence, readjust the centering magnets for that color CRT to reconverge them. Repeat the linearity (if applicable), height control, and width coil steps to reconverge the top, bottom and side lines, if necessary. Repeat the steps as many times as necessary to obtain the proper convergence. If the lines at the left and right sides cannot be converged, adjust the width coil(s) for the best possible compromise. You will fine tune these lines in the following steps, if necessary.

20. If either the red or blue crosshatch pattern lines are inside the green lines (toward the center of the screen), adjust Green Horizontal Linearity control RX8562 on the raster registration module to reconverge the green lines with the innermost pattern lines.

21. Use the Red or Blue Horizontal Linearity control (RX8561 or RX8571) and converge the red or blue lines with the lines you converged in the previous step.

22. If the red and blue lines are both outside of the green lines at the right side, adjust only the Red and Blue Horizontal Linearity controls (LX8575 and LX8576) to converge them with the green lines. Make sure you keep the green lines centered on the screen with the centering control.

23. If necessary, alternately adjust the Horizontal Width coils and Horizontal Centering controls for the best convergence of the red and blue lines with the green lines at the left and right sides.

24. Set the crosshatch switch to NORMAL.

25. Have someone help you raise the TV cabinet to its upright position.

26. Have another person observe the screen while you make the following touch-up adjustments:

A. If it has not already been done, turn the COLOR control on the control panel fully counterclockwise.

B. Turn the PICTURE control to obtain a dim picture.

C. If the picture tint is a color other than gray, advance the appropriate G2 control(s) clockwise to obtain a gray raster. Do not advance more than two controls.

D. Turn up the PICTURE control for a normal brightness picture.

E. The picture should be black and white. If the white areas of the picture have a color tint, adjust one or two of the chroma/luminance module Gain controls (R2727, R2732, or R2738) to increase the missing color(s) to remove the tint from the white areas of the picture.

27. With the help of another person watching the screen, touch-up the convergence adjustments, as necessary.

BLACK LEVEL RANGE CONTROL

Refer to Pictorial 3-2 for the following steps.

Set the control panel controls as follows:

( ) PICTURE control fully counterclockwise.

( ) BLACK LEVEL control to the center (detent) position.

( ) COLOR LEVEL control fully counterclockwise.

( ) Internal black level (BL) control until you just have light on the screen. Use the large end of the alignment tool to make this adjustment.

AGC DELAY

Refer to Pictorial 3-1 for the following steps.

( ) Tune to the strongest channel in your area.

( ) Turn the PICTURE control to obtain a normal picture.

( ) Have someone watch the screen while you adjust the Video IF module "AGC Delay" control (R1353) counterclockwise until the picture is snowy. Then adjust the control back until the snow is gone. If there is a channel 6 operating in your area, tune to this channel and adjust the AGC Delay control for minimum "beat" in the picture.

NOTE: If you are using a signal source other than a TV station (video game, video cassette recorder, etc.) with this TV Set, you may have to readjust the AGC Delay control.

COLOR SENTRY

NOTE: Adjust the following control panel controls and switch:

( ) BLACK LEVEL control to center (detent).

( ) SHARPNESS control to center (detent).

( ) COLOR LEVEL and TINT controls for the desired picture.

( ) COLOR SENTRY switch to its center position. Use the alignment tool to adjust the internal Color Level (CL) and Tint (T) controls for the desired color tones. Leave the controls at this position for the following section.

SAFETY TEST

Refer to Pictorial 3-1 for the following steps.

( ) Have someone help you lay the cabinet face down on a carpeted floor.

NOTE: If the high voltage in your TV Set were to malfunction and increase sufficiently in voltage, harmful X-rays could be produced. This Set has an automatic shut-down circuit to prevent this from occurring. The following test will ensure that this shut-down circuit is operating properly.

CAUTION: The three chroma/luminance module connectors 2P, 2N, and 2Q must never be simultaneously disconnected. Operation of the Set without at least one of these connected will result in serious damage to the picture tubes (CRTs).

( ) Press the POWER keypad to turn the TV Set off.

( ) Unplug connectors 2P and 2N from the chroma/luminance module.

( ) Locate the 11 kΩ (brn-brn-org-gld) test resistor assembly you set aside earlier and connect the socket to pin 1 of chroma/luminance module plug 2N.

( ) Turn the TV Set on.

( ) Touch the bare end of the wire coming from the resistor to pin 4 of chroma/luminance module plug 2A4. The Set should turn off.

( ) Move the test resistor socket from pin 1 of plug 2N to pin 1 of plug 2P.

( ) Turn the Set back on and touch the end of the wire to pin 4 of plug 2A4 once more. The Set should turn off.

( ) Remove the test resistor socket from plug 2P and reinstall connector 2P.

( ) Remove connector 2Q from chroma/luminance plug 2Q and connect the test resistor socket to pin 1 of the plug.

( ) Turn the Set on and touch the bare wire end of the test resistor to pin 4 of plug 2A4. The Set should turn off.

( ) Remove the test resistor socket from the plug pin and set it aside.

( ) Reconnect connectors 2N and 2Q to their respective chroma/luminance module plugs.

( ) Refer to Detail 3-1D and install the viewing port light shield to the bottom shelf with six 8-15 × 3/4″ hex-head screws w/flat washers. Be careful not to disturb any focus module control settings when you tighten the screws.

( ) Postition the cabinet to its upright position.

NOTE: If the previous tests did not produce the proper results, you should have the chroma/luminance module repaired. Refer to the "Service Facilities" section on Page 84.

This completes the "Safety Test."

FINAL TESTS

Refer to Pictorial 3-2 for the following steps.

( ) Turn the TV Set on.

( ) Press the keyboard's TIME RECALL (RCL) keypad. Then use the TIME SET (HR SET and MIN SET) keypads and set the clock. After you set the clock, it will start keeping time until you unplug the Set.

( ) Use the remote control transmitter and change the channel by pressing the new channel number(s) and then the ENTER/RECALL keypad.

( ) Press the POWER keypad to turn the Set off.

AUDIO AMPLIFIER CHECK

Refer to Pictorials 3-1 and 3-2 for the following steps.

( ) Set the STEREO SOURCE switch to AUX.

( ) Set the VIDEO SOURCE switch to AUX.

( ) Turn the Set on.

( ) On the audio/video panel, touch the center pin of the "L" STEREO INPUT jack. You should hear hum from the left speakers.

( ) Touch the center pin of the "R" STEREO INPUT jack and you should hear hum from the right speakers.

( ) Turn the Set off.

( ) Set the STEREO and VIDEO SOURCE switches to TV (down).

( ) Carefully position your TV Set in its upright position.

This completes the "Adjustments and Alignment." Proceed to "Final Assembly."

FINAL ASSEMBLY

Refer to Pictorial 3-3 for the following steps.

( ) Disconnect the antenna from the TV Set. NOTE: It is not necessary to unplug the AC line cord to mount the back panel. If you unplug the line cord, you will have to reset the clock.

( ) Hook the cabinet back over the two cabinet back support brackets and then loosely mount the back to the cabinet with the eighteen screws you removed earlier.

( ) Mount the cabinet back to the antenna terminal and audio/video panel with the remaining four 8-18 × 3/4″ hex-head screws w/flat washers. Tighten these screws.

( ) Tighten the eighteen back panel screws.

( ) Mount the two wall spacers to the cabinet with two 2-1/4″ phillips screws at EA and EB. These holes are not predrilled.

Remove the backing from the following labels and press them onto the cabinet back panel at the indicated locations:

( ) Power consumption label.

( ) Manufacturing date label.

( ) Blue and white label.

( ) Audio/video label.

( ) Refer to Pictorial 3-4 and remove the backing from the Parental Control label, located inside your remote control transmitter box, and press the label inside the raised area at the rear of the transmitter.

This completes the "Final Assembly."

ANTENNAS

This section provides you with information concerning antennas, antenna lead-ins (twin-lead and shielded cable), proper antenna orientation, and signal preamplifiers for fringe areas. This information will help you select the proper antenna installation for maximum performance from your Television Set.

Your 45″ TV Set is designed to operate with broadband type antennas, such as inline types recommended for color TV reception. It is very important to use an antenna that is suited for your area. Some indoor and outdoor antennas that are used satisfactorily for black and white TV reception do not provide sufficient signal strength and bandwidth for color television. The impedance of the antenna and the lead-in can be either 300 Ω or 75 Ω.

It is important to have a clean, strong, signal for large screen projection TV receivers. A weak, snowy signal, which may be acceptable on a 19" portable TV, will be quite objectionable to view on a large screen projection TV set.

Refer to Pictorial 4-1 for the following description.

The connector on the back of the Set has an impedance of 75 Ω and connects to the tuner. If the cable coming from your antenna is 75 Ω, you can connect the cable directly to the connector as shown in Part 1 of Pictorial 4-1. If the cable coming from your antenna is 300 Ω, you must use the 300 Ω to 75 Ω balun supplied with your TV as shown in Part 2 of Pictorial 4-1. The 300 Ω twin lead is then connected to the balun terminal screws.

ANTENNA LEAD-INS

Color television signals are carried from the antenna to the TV Set by 300 Ω twin lead or 75 Ω shielded (coaxial) cable. The most commonly used types of twin lead and shielded cable are listed below, with a description of how they respond to weather conditions.

300 Ω Flat Twin Lead — Little signal loss in fair weather. High signal loss in wet weather, especially on UHF channels.

300 Ω Tubular Twin Lead — Little signal loss in fair weather. Less signal loss in wet weather than with flat twin lead. Better for UHF reception than flat twin lead.

The signal loss may be even greater with twin lead if it has accumulated a noticeable amount of foreign matter (dirt, chimney soot, etc.). Do not route twin-lead inside a metal pipe or within 5 inches of any metal surface. The insulation also ages from the weather and develops minute cracks.

75 ΩLow-Loss Shielded Cable — Slightly more signal loss in fair weather than with twin lead. However, it has the following advantages over twin lead: No additional signal loss in wet weather, less affected by local interference, lasts much longer, no stand-off insulators needed to keep it away from antenna tower or pole, can be routed inside a metal pipe. Excellent for TV reception (color or black and white) and stereo-FM reception.

CONNECTIONS

When 75 Ω cable is used, a 75 Ω antenna should be used. If you have a single, all channel, 75 Ω lead-in, connect it as shown in Pictorial 4- 1 Part 1.

CATV or Master Antenna Systems — The CATV antenna connection is shown in Pictorial 4-1 Part 1. The UHF stations are converted to unused VHF channels. Master antenna systems used in motels, hotels, and trailer parks are similar and use the same antenna connections.

300 Ω Twin Lead — This lead-in is connected as shown in Pictorial 4- 1 Part 2.

ANTENNA ORIENTATION

Antennas require more careful orientation for good color TV reception than for black and white TV reception. Some antenna positions may result in good black and white pictures, but poor color pictures. This is mainly because the color information is transmitted differently than the black and white information. If a new antenna is being installed, or if the position of an older antenna seems questionable, orient it while you view a color program for best reception.

If the antenna is not oriented properly, signals from several directions may be reaching the antenna at the same time. These signals are usually reflected from objects such as large buildings or large metal structures. The reflected signals may cause slight phase shifts in the TV signal. On black and white pictures, this would result in a very slight ghost (a duplicate image appearing next to the actual image) or smear. On color pictures, however, the phase shift can cause excessive color smear, ghosting and incorrect color areas. To eliminate this problem, rotate the antenna until you get the best picture.

Distorted pictures can sometimes be caused by too strong a signal, especially in metropolitan areas, where the transmitting antenna is close to the receiving antenna. In this case, you can reduce the signal from the antenna by using an attenuator pad. Pictorial 4-2 shows two types of attenuator pads, one for 75 Ω impedance lead-in and one for 300 Ω impedance lead-in. Select the correct pad for your lead-in and connect it between the antenna and the TV Set as shown. You can obtain the resistors to make these pads from any local electronic parts store.

SIGNAL PREAMPLIFIERS

If you live in a fringe area where it is difficult to receive a strong TV signal, a preamplifier may be a solution to your problem. A preamplifier will amplify the weak signal received by the antenna. If you purchase a unit of this type, make sure the specifications allow it to be used for color as well as black and white signals. If the bandpass specifications are too narrow, a phase shift could occur which could cause color smear and incorrect color areas, where a black and white picture would not be affected.

There are two types of preamplifiers; outdoor and indoor.

The **outdoor** preamplifier is mounted on the antenna mast near the antenna. The antenna is connected to the input terminals, and the lead-in is connected to the output terminals. The other end of the lead-in is connected through the preamplifier power supply to the television antenna terminals. The power supply which supplies operating voltages for the preamplifier is mounted in the house, and the voltages are fed to the preamplifier through the lead-in.

The main advantage of using an outdoor preamplifier of this type is that only the TV signal from the antenna is amplified and not the noise picked up by the lead-in. This gives a better signal-to-noise ratio and less snow in the picture. In addition, very weak signals are amplified before they become attenuated by inherent line losses in the lead-in cable.

The **indoor** preamplifier is installed inside the house between the antenna and TV set. This unit amplifies the signal as well as an outdoor unit, however, any noise picked up in the lead-in is also amplified.

The indoor preamplifier is a good unit to use when more than one TV set is connected. You can usually purchase this type of unit with more than one set of output terminals. Additional TV sets can be connected to these terminals. This serves as an amplifier stage for each TV set, and also provides isolation to keep the sets from interfering with each other.

When you use a preamplifier as a multi-set coupler in strong signal areas, the input of the preamplifier (depending on the circuitry) may be overdriven. This would result in cross-modulation problems in the preamplifier and cause interference on one or more channels. Be sure to use an attenuator pad in these cases, such as the one shown in Pictorial 4-2, on the input of the preamplifier to reduce the amount of signal to the preamplifier.

NOTE: Many preamplifiers are more receptive to interference than the TV receiver because of their broad-band input. If your TV has interference, disconnect the preamplifier and check the reception without it. If this eliminates the interference, you can use an appropriate filter in the lead-in going into the preamplifier for the antenna. Do not overlook the possibility that a strong FM station could also be causing the interference.

ANTENNA SWITCH

The four-position Antenna Switch, Model GSZ-4600, is a special optional accessory for the GR-4500 Projection TV Set. This switch, which mounts on the rear of the TV Set, has four positions, 1, 2, 3, and 4. Four signal sources can be connected to the switch, including CATV and subscription TV decoders, VCRs, video disc players, video games, and home computers.

A key on the TV keyboard or the remote control transmitter steps through the four Switch positions in sequence. The on-screen display is converted to an antenna switch position indicator. The word "ANTENNA" appears with the number of the switch position in use.

NOTE: The on-screen antenna position display is operable whether the Antenna Switch is connected to the TV Set or not.

OPERATION

NOTE: Be sure to read the "Television Safety Guide" before you operate your TV Set.

GENERAL

SELECTING THE LOCATION

Place your TV set where sunlight or bright light will not fall directly on the screen. Allow a comfortable viewing distance, usually twelve feet or more.

Be sure the location has an accessible antenna system. A strong signal is necessary to obtain the best possible color picture. Refer to the "Antennas" section of the Manual.

POWER SOURCE

Your TV set is designed to operate on standard 120 volt, 60 Hz AC voltage. DO NOT ATTEMPT TO OPERATE YOUR TV SET ON DC VOLTAGE.

SPECIAL PRECAUTIONS

If you use your TV set to play video games, do not adjust the PICTURE control (brightness) for an excessively bright game display. To do so over a long period of time could permanently imprint the display on the picture tubes. To reduce this possibility, alternate your use of the game with normal TV viewing. Always turn the game off promptly when you are finished using it.

If you do not intend to use the TV set for a long period of time (such as during a vacation), we recommend that you unplug the line cord for added protection against possible damage from lightning or power surges. In addition, if your set is connected to an outside antenna, disconnect the lead-in wire at the antenna connector on the back of the set.

TOP PANEL CONTROLS

Refer to Pictorial 5-1 for the location of the following top controls.

COLOR SENTRY switch — Position this switch to Color Sentry (center) to turn on the light sensor, color signal monitor, tint stabilizer, color level lock, and contrast regulator circuits. These circuits work together to provide you with an excellent color picture automatically, scene to scene and channel to channel.

To make the Color Sentry give you the kind of picture you desire, perform the following steps.

1. Push the POWER keypad to turn the TV set on and allow it to warm up for several minutes.

2. Select a channel that is telecasting in color.

3. Be sure the COLOR SENTRY switch is set to Color Sentry.

4. Turn the BLACK LEVEL control to the middle, or detent position. This position generally assures you that the areas of the picture which should be black are black.

5. Turn the PICTURE control in either direction to obtain the brightness level you desire.

6. If the dark areas of the picture and the colors appear faded or washed out, turn the BLACK LEVEL control counterclockwise. If light backgrounds and colors appear to be too dark, turn the control clockwise.

7. We recommend that you set the SHARPNESS control to midrange (detent). If you prefer a softer picture, turn the control counterclockwise; for a sharper picture, turn the control clockwise.

8. If the color or tint of the picture still does not appeal to you when the COLOR SENTRY switch is in the Color Sentry position, refer to "Color Sentry" on Page 45 and reperform the adjustments outlined there.

   With the COLOR SENTRY switch in the "Video Filter" position, the Color Sentry circuit will still be activated, but the picture sharpness will be slightly reduced.

   With the COLOR SENTRY switch off, the Color Sentry is inoperative and the COLOR LEVEL and TINT controls are operational.

The following paragraphs describe the action of each top panel control and switch; and where applicable, will describe its interaction with other controls and/or switches. For the best results, make sure you understand each of the control and switch functions.

POWER keypad — Turns the TV set on and off.

VOLUME UP (↑) keypad — Increases the volume as long as the keypad is pressed. Continued pressure will increase the volume to its maximum level.

VOLUME DOWN (↓) keypad — Decreases the volume as long as the keypad is pressed. Continued pressure will decrease the volume to its minimum level.

CHANNEL UP (↑) keypad — "Up-scans" the programmed channels in their lower-to-higher numbered sequence. This process will continue as long as the keypad is pressed.

CHANNEL DOWN (↓) keypad — "Down-scans" the programmed channels in their higher-to-lower numbered sequence. This process will continue as long as the keypad is pressed.

0 THROUGH 9 CHANNEL keypads — Selects the desired channel. To select a channel, press the numbered keypad(s) that match the desired channel number. The channel number will appear on the screen after you press a keypad. After a short delay, the selected channel will be tuned in. If you desire the channel to appear on the screen, immediately press the desired channel number keypad(s) and then the ENTER RECALL keypad.

ENTER RECALL keypad — This keypad, and the 0 through 9 keypads, will select a channel immediately without a delay. In addition, whenever you select a channel and press the ENTER RECALL keypad, that number is automatically entered into the tuner control memory. You can use this keypad to recall a channel number and the time display on the screen.

PARENTAL CONTROL (PC) keypad — Allows you to "lock-out" any channel(s) you do not wish others to view. This feature remains in effect for up to 12 hours when you enter a personal code of up to four digits in the TV's memory circuit. This feature is explained in detail in the "Parental Control Feature" section on Page 58.

CHANNEL SKIP keypad — Allows you to skip or program out a channel from the scan sequence. Use the following procedure:

1. Press the numbered keypad(s) to select the channel you wish to skip. Then press the SKIP keypad to remove the channel from the TV's memory. The letters CH PO (channel programmed out) and the time will appear briefly on the screen, followed by the channel numbers you programmed out.

2. Repeat the first step for any other channels you wish to skip.

NOTE: You can reprogram any channel that was programmed out by following the instructions under the previous section entitled "Enter Recall." You cannot reprogram these channels using the remote control transmitter.

TIME RECALL (RCL) keypad — Recalls the time display on the screen. This keypad is normally used only with the time set keypads, which are described next.

TIME (HR SET and MIN SET) keypads — These keypads set the correct time. The first time you plug in your TV set, or if there has been a power interruption, you will have to reset the clock. To set the correct time, first press the TIME RECALL (RCL) keypad. Then, while the time is on the screen, press and hold the HR SET (hour) keypad until the correct hour is displayed.

Use the same procedure with the MIN SET (minute) keypad to set the clock for the correct minute display. NOTE: If the time display disappears while you are trying to set the time, press the TIME RECALL (RCL) keypad to recall the display. The time is not affected when you press the POWER keypad to turn the set off.

ANTENNA keypad — Selects one of four antenna inputs when the antenna switch accessory (GSZ-4600) is used. When this accessory is not used, selecting any antenna will have no effect on your reception, but the antenna number display will be shown on the screen.

STEREO/MONO/2ND AUD (AUDIO) keypad — Selects the desired audio source. When you press this keypad, the Stereo, Monophonic, and second Audio programs will cycle and then repeat. At the same time, the on-screen display will indicate the source selected as well as the sources available.

STEREO SOURCE switch — Activates the various jacks on the TV's audio/video panel. In the AUX position, the STEREO AUDIO INPUT jacks on the panel are activated. In the TV position, the regular TV sound is selected.

Operation	STEREO SOURCE Switch	VIDEO SOURCE Switch
Audio In	AUX	Either position
Video In	Either position	AUX
Stereo In	AUX	Either position
Audio Out	TV	Either position
Video Out	Either position	AUX

VIDEO SOURCE switch — Activates the audio/video panel's VIDEO INPUT jack in the "Aux" position and the regular TV picture in the "TV" position.

NOTE: Do not connect the "Audio In" and "Audio Out" to a VCR at the same time or the sound will oscillate (squeal).

EXTENDED STEREO switch — Electronically enhances stereo broadcast sound signals for greater left and right channel separation.

BAND SELECTOR switch — Refer to Table 5-1 on Page 56 for the correct setting of this switch. In the two CATV positions, the TV set is capable of receiving the special cable TV channels that are located between the ordinary channels.

CATV channels are designated by the cable TV industry as channels 2 through 13, A-8 (4+), A-2, A-1, A through W, AA through ZZ, and AAA, BBB, and ultraband channels 65 through 120. Therefore, to select the lettered channels, you must translate them to a numbered channel. Table 5-2 on Page 60 is provided so you can easily keep track of the cable TV channels, which are provided by your CATV company. Refer to the "TV Frequencies" charts on Pages 60 through 67.

AFC switch — Refer to Table 5-1 for the correct setting of this switch. Normally, you will keep this switch in the NORM position. If the signals your set is receiving vary from FCC standard frequencies, you may get poor reception or no picture. This condition is most prevalent when you use a CATV (cable) or MATV (master) antenna, or some types of video games. If you experience poor reception when you use one of these sources, slide the switch to the SPCL (Special) position and recheck your reception.

PICTURE control — Adjusts the picture brightness to the desired level. This control automatically adjusts the contrast and color level to the proper balance.

BLACK LEVEL control — Sets the black areas of the picture to the desired level. Once you have this control properly set, an electronic contrast regulator automatically maintains this preset black level from scene to scene. Use the PICTURE control to make any further brightness adjustments.

COLOR LEVEL control — Changes the intensity of the colors. If the colors appear faded or weak, turn the control clockwise. If the colors appear vivid or intense (see Photo C, fold-in sheet), turn the control counterclockwise. This control has no effect when Color Sentry is selected.

TINT control — Adjusts the picture for the most natural flesh tones. If the flesh tones appear purple (see Photo D, fold-in sheet), turn the control clockwise. If the flesh tones appear green (see Photo E), turn the control counterclockwise. This control has no effect when Color Sentry is selected.

SHARPNESS control — Use this control to adjust the detail in the picture. Turn the control counterclockwise for a softer picture. For more sharpness, turn the control clockwise.

BASS control — Varies the low frequency response of both audio channels simultaneously. Clockwise rotation from center (0) increases the low frequency levels; counterclockwise rotation from center decreases the low frequency levels.

TREBLE control — Varies the high frequency response of both audio channels simultaneously. Clockwise rotation from center (0) increases the high frequency levels; counterclockwise rotation from center (0) decreases the high frequency levels.

BALANCE control — Adjusts the left or right channel amplifiers so there is equal sound from the left and right channel speakers. The sound is at equal levels from both channels at the center (0) position. Counterclockwise rotation will decrease the sound from the right channel and clockwise rotation will decrease the sound from the left channel.

Table 5-1

Your TV Signal	BAND SELECTOR Switch	AFT Switch
Indoor or outdoor antenna	VHF UHF	NORM
Cable antenna System (CATV NORM)	CATV NORM	NORM OR SPCL*
Cable antenna System (CATV HRC)	CATV HRC	NORM OR SPCL*
Master antenna System (MATV)	VHF UHF	NORM OR SPCL*
Video games	VHF UHF	SPCL

*Refer to "AFC switch" for more information.

REMOTE CONTROL TRANSMITTER

Refer to Pictorial 5-2 for the location of the Remote Control Transmitter's pushbuttons.

NOTE: Most of the pushbuttons on the Remote Control Transmitter are self-explanatory and operate similarly to their counterparts on the top control panel of the TV set. Only those pushbuttons that do not appear on the top panel keypads are described below.

FLASHBACK pushbutton — Allows the TV to "remember" the last channel you viewed before you switched to your present channel. With this feature, you can switch back and forth between the last two channels you have selected by simply pressing a single button (PAUSE II – FLASHBK) on the Remote Control Transmitter.

TV/VCR switch — Operates the TV set when set to "TV", or a video cassette recorder when set to "VCR." NOTE: This Remote Control Transmitter will only operate Zenith VHS VCR's.

MUTE pushbutton — Turns the sound on and off.

Your Remote Control Transmitter uses one "J" size 6-volt alkaline battery.

SPECIAL NOTE: You can select any TV channel with the Remote Control Transmitter. However, these channels do not enter the TV set's memory. You can program channels into memory only through the TV's top control panel keyboard.

REAR PANEL CONNECTIONS

NOTE: Refer to the "Antennas" section of this Manual for information concerning the antenna connections.

Refer to Pictorials 5-3 and 5-4 for the following description.

REDI-PLUG — A provision to add external accessories such as Teletext and cable decoders.

Audio/Video Panel — With the top control panel STEREO SOURCE switch in the "Aux" position and the VIDEO SOURCE switch in the "Aux" position, you can operate a VCR (video cassette recorder), video disc player, or TV games through the STEREO AUDIO INPUT and VIDEO INPUT jacks on this panel. In this position, both sets of speakers will operate simultaneously (mono). Use 75 Ω shielded cable for all video interconnections and audio shielded cable for all audio interconnections.

The SPEAKERS switch on the panel should be in the INT (internal) position to operate the TV set's speakers. With this switch in the EXT (external) position, the internal speakers are switched off and there will be a TV picture but no sound from the TV speakers. You can connect external 8Ω speakers to the SPEAKERS/HIFI output jacks.

With the top control panel STEREO SOURCE switch in the "Aux" position, you can operate a stereo receiver through your TV speakers using the L and R STEREO INPUT jacks. The speakers will operate in stereo.

DIRECT VCR OPERATION

To play the recording back, connect shielded cables from the tape recorder's video and audio outputs to the respective TV inputs. Place the TV's VIDEO SOURCE and STEREO SOURCE switches to the "Aux" positions. All the TV's control panel adjustments will operate normally during playback, except for the channel selection.

The video and audio cable connections to the recorder must be disconnected whenever the antenna connection is made through the recorder. With some recorders, a "loop" effect will result in loss of picture and a squealing in the sound due to simultaneous signal paths. Consult the recorder's instruction manual for a solution to problems which you may encounter.

PARENTAL CONTROL

Certain TV programs or channels may be unsuitable for general home viewing. The Parental Control feature permits you to "lock out" any TV channels that you feel are unsuitable for younger viewers for 12 hours.

To do this, you can enter your own secret code of up to 4-digits into the TV's memory unit. Any such coded channel will then have no picture or sound for 12 hours unless you reactivate or decode it sooner. Only the proper code numbers will reactivate the coded channels before the 12-hour period is over.

The Parental Control feature cannot be defeated or circumvented by a power interruption or by unplugging the TV. When power is restored, the coded channels will be reactived for a new 12 hour period. This period is controlled by a separate timer so it cannot be defeated by advancing the clock display.

For your convenience, only channels in the channel memory should be used for this feature.

If you are unsure whether the 12-hour period has elapsed, check by scanning up or down the channels to see if any are present. Any blanked channels will show on the screen with a "PC" at the lower right of the screen.

To activate the Parental Control feature:

1. Turn the TV on.

2. Use the UP/DOWN scan buttons to tune to the channel you wish to lock out.

3. Press the PC (Parental Control) button on the remote control transmitter, or the PC keypad on the TV keyboard. You will see the following display on the lower right side of your screen:

PAR. CONT 0

The display will remain on the screen for 30 seconds.

4. While the display is on, press the 0 (zero) channel numbered button. You will see a black bar at the lower right of the screen for 30 seconds. You must choose your Parental Control code during that period (see Step 4). If you do not choose the code during that time, the display will be automatically removed and the TV channel will return to normal operation.

5. Press up to four numbered buttons (or keypads) to select your code. The numbers will appear on the display inside the black bar. Pick a familiar number that is easy to remember. You may even wish to write the number down in case you forget it and need it as a reference in order to reactivate the channel before the 12 hour period is over.

6. Press the ENT/RCL button to enter the code for the selected channel into the TV memory. The screen will automatically go blank and the sound will mute. The on-screen display will show the channel number you selected and the letters "PC" to indicate the the Parental Control feature has been activated. After 5 seconds the TV will automatically tune in the next higher programmed channel.

Now, if a locked-out channel is selected within the 12 hour period, the screen will be blank except for the channel number and the letters "PC", and the sound will be muted.

7. Repeat coding steps 1 to 5 for any other channels you wish to lock out.

Once again, briefly, here's the lock-out procedure:

1. Turn the TV on.

2. Use the UP/DOWN scan buttons to select the channel you wish to lock out.

3. Press the PC button.

4. Press the 0 (zero) button.

5. Press the 1- to 4-digit numbered buttons to select the code.

6. Press the ENT/RCL button.

NOTE: To lock out additional channels, you must use the same code numbers that you used to "lock out" the first channel you selected. No other number will work. Any channel you add to the lock-out feature will restart the 12-hour period from the beginning for all the lock-out channels.

To deactivate the Parental Control feature before the 12-hour lock out period has ended:

1. Turn the TV on.

2. Use the UP/DOWN scan buttons to tune in the coded channel. The channel numbers and the letters "PC" will be displayed and remain on for about 5 seconds.

3. During the 5 second display period, press the PC button on the remote control transmitter or the TV keyboard. The following display will appear on the screen for about 30 seconds:

PAR. CONT. 0

If you do not press the PC button within the 5 second display time, the TV will automatically tune to the next highest normally viewed channel.

4. Press the 0 (zero) channel button and the letters PC will be displayed on the lower right of the screen.

If you do not press the 0 channel button within 30 seconds, the TV will automatically tune to the next highest normally viewed channel.

5. Enter the code you previously selected to lock out the channel. You have 30 seconds to do this before the TV switches to the next highest channel.

6. Press the ENT/RCL button to decode the channel. The channel will then unlock and the picture and sound will return.

NOTE: The next time you wish to lockout a channel, you may use the same code number or select a new one, up to 4-digits long. If you use a new number, there can be no other channels currently locked out.

Once again briefly, here's the unlocking procedure:

1. Turn the TV on.

2. Use the UP/DOWN scan buttons to select the channel you wish to unlock.

3. Press the PC button.

4. Press the 0 (zero) button.

5. Press the 1- to 4-digit numbered buttons to select the code.

6. Press the ENT/RCL button.

TV FREQUENCIES

CATV (VHF) Channel.	2	3	4	A-8 (4+)	5	6	7	8	9	10	11	12	13
Select Channel Number	2	3	4	00	5	6	7	8	9	10	11	12	13
Actual TV Station.**	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

CATV (Midband) Channel.	A-2	A-1	A	B	C	D	E	F	G	H	I
Select Channel Number	0	1	14	15	16	17	18	19	20	21	22
Actual TV Station.**	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

CATV (Superband) Channel.	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
Select Channel Number	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Actual TV Station.**	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

CATV (Hyperband) Channel.	AA	BB	CC	DD	EE	FF	GG	HH	II	JJ	KK	LL	MM	NN
Select Channel Number	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Actual TV Station.**	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	OO	PP	QQ	RR	SS	TT	UU	VV	WW	XX	YY	ZZ	AAA	BBB
	51	52	53	54	55	56	57	58	59	60	61	62	63	64
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

CATV (Ultraband) Channel.														
Select Channel Number	65	66	67	68	69	70	71	72	73	74	57	76	77	78
Actual TV Station.**	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	79	80	81	82	83	84	85	86	87	88	89	90	91	92
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	93	94	95	96	97	98	99	100	101	102	103	104	105	106
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	107	108	109	110	111	112	113	114	115	116	117	118	119	120
	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

**You may write in the actual station name or channel information supplied by your cable TV (CATV) company.

Table 5-2

TELEVISION BROADCAST CHANNELS

VHF FREQUENCY CHART

CHANNEL INDICATOR	BAND	VIDEO CARRIER	AUDIO CARRIER	OSC FREQ
		Low Band VHF		
2	54 - 60	55.25	59.75	101
3	60 - 66	61.25	65.75	107
4	66 - 72	67.25	71.75	113
5	76 - 82	77.25	81.75	123
6	82 - 88	83.25	87.75	129
		High Band VHF		
7	174 - 180	175.25	179.75	221
8	180 - 186	181.25	185.75	227
9	186 - 192	187.25	191.75	233
10	192 - 198	193.25	197.75	239
11	198 - 204	199.25	203.75	245
12	204 - 210	205.25	209.75	251
13	210 - 216	211.25	215.75	257

UHF FREQUENCY CHART

CHANNEL INDICATOR	BAND	VIDEO CARRIER	AUDIO CARRIER	OSC FREQ
14	470 - 476	471.25	475.75	517
15	476 - 482	477.25	481.75	523
16	482 - 488	483.25	487.75	529
17	488 - 494	489.25	493.75	535
18	494 - 500	495.25	499.75	541
19	500 - 506	501.25	505.75	547
20	506 - 512	507.25	511.75	553
21	512 - 518	513.25	517.75	559
22	518 - 524	519.25	523.75	565
23	524 - 530	525.25	529.75	571
24	530 - 536	531.25	535.75	577
25	536 - 542	537.25	541.75	583
26	542 - 548	543.25	547.75	589
27	548 - 554	549.25	553.75	595

UHF FREQUENCY CHART (Continued)

CHANNEL INDICATOR	BAND	VIDEO CARRIER	AUDIO CARRIER	OSC FREQ
28	554 - 560	555.25	559.75	601
29	560 - 566	561.25	565.75	607
30	566 - 572	567.25	571.75	613
31	572 - 578	573.25	577.75	619
32	578 - 584	579.25	583.75	625
33	584 - 590	585.25	589.75	631
34	590 - 596	591.25	595.75	637
35	596 - 602	597.25	601.75	643
36	602 - 608	603.25	607.75	649
37	608 - 614	609.25	613.75	655
38	614 - 620	615.25	619.75	661
39	620 - 626	621.25	625.75	667
40	626 - 632	627.25	631.75	673
41	632 - 638	633.25	637.75	679
42	638 - 644	639.25	643.75	685
43	644 - 650	645.25	649.75	691
44	650 - 656	651.25	655.75	697
45	656 - 662	657.25	661.75	703
46	662 - 668	663.25	667.75	709
47	668 - 674	669.25	673.75	715
48	674 - 680	675.25	679.75	721
49	680 - 686	681.25	685.75	727
50	686 - 692	687.25	691.75	733
51	692 - 698	693.25	697.75	739
52	698 - 704	699.25	703.75	745
53	704 - 710	705.25	709.75	751
54	710 - 716	711.25	715.75	757
55	716 - 722	717.25	721.75	763
56	722 - 728	723.25	727.75	769
57	728 - 734	729.25	733.75	775
58	734 - 740	735.25	739.75	781
59	740 - 746	741.25	745.75	787
60	746 - 752	747.25	751.75	793
61	752 - 758	753.25	757.75	799
62	758 - 764	759.25	763.75	805
63	764 - 770	765.25	769.75	811
64	770 - 776	771.25	775.75	817
65	776 - 782	777.25	781.75	823
66	782 - 788	783.25	787.75	829
67	788 - 794	789.25	793.75	835
68	794 - 800	795.25	799.75	841
69	800 - 806	801.25	805.75	847

CATV CHANNELS

VHF AND CATV MID BAND FREQUENCY CHART

CHANNEL NUMBER	BAND	VIDEO CARRIER	AUDIO CARRIER	OSC FREQ	CHANNEL INDICATOR
		Low Band VHF			
2	54 - 60	55.25	59.75	101	2
3	60 - 66	61.25	65.75	107	3
4	66 - 72	67.25	71.75	113	4
A-8(4+)	70.75 - 76.75	72.00	76.50	117.75	00
5	76 - 82	77.25	81.75	123	5
6	82 - 88	83.25	87.75	129	6
		Mid Band CATV			
A-2	108 - 114	109.25	113.75	155	0
A-1	114 - 120	115.25	119.75	161	1
A	120 - 126	121.25	125.75	167	14
B	126 - 132	127.25	131.75	173	15
C	132 - 138	133.25	137.75	179	16
D	138 - 144	139.25	143.75	185	17
E	144 - 150	145.25	149.75	191	18
F	150 - 156	151.25	155.75	197	19
G	156 - 162	157.25	161.75	203	20
H	162 - 168	163.25	167.75	209	21
I	168 - 174	169.25	173.75	215	22
		High Band VHF			
7	174 - 180	175.25	179.75	221	7
8	180 - 186	181.25	185.75	227	8
9	186 - 192	187.25	191.75	233	9
10	192 - 198	193.25	197.75	239	10
11	198 - 204	199.25	203.75	245	11
12	204 - 210	205.25	209.75	251	12
13	210 - 216	211.25	215.75	257	13

HRC SUPERBAND AND HYPERBAND CATV FREQUENCY CHART

HRC CHANNEL NUMBER	BAND	VIDEO CARRIER	AUDIO CARRIER	OSC FREQ	CHANNEL INDICATOR
		Superband CATV			
J	216 - 222	217.25	221.75	263	23
K	222 - 228	223.25	227.75	269	24
L	228 - 234	229.25	233.75	275	25
M	234 - 240	235.25	239.75	281	26
N	240 - 246	241.25	245.75	287	27
O	246 - 252	247.25	251.75	293	28
P	252 - 258	253.25	257.75	299	29
Q	258 - 264	259.25	263.75	305	30
R	264 - 270	265.25	269.75	311	31
S	270 - 276	271.25	275.75	317	32
T	276 - 282	277.25	281.75	323	33
U	282 - 288	283.25	287.75	329	34
V	288 - 294	289.25	293.75	335	35
W	294 - 300	295.25	298.83	341	36
		Hyperband CATV			
AA	300 - 306	301.25	305.75	347	37
BB	306 - 312	307.25	311.75	353	38
CC	312 - 318	313.25	317.75	359	39
DD	318 - 324	319.25	323.75	365	40
EE	324 - 330	325.25	329.75	371	41
FF	330 - 336	331.25	335.75	377	42
GG	336 - 342	337.25	341.75	383	43
HH	342 - 348	343.25	347.75	389	44
II	348 - 354	349.25	353.75	395	45
JJ	354 - 360	355.25	359.75	401	46
KK	360 - 366	361.25	365.75	407	47
LL	366 - 372	367.25	371.75	413	48
MM	372 - 378	373.25	377.75	419	49
NN	378 - 384	379.25	383.75	425	50
OO	384 - 390	385.25	389.75	431	51
PP	390 - 396	391.25	395.75	437	52
QQ	396 - 402	397.25	401.75	443	53
RR	402 - 408	403.25	407.75	449	54
SS	408 - 414	409.25	413.75	455	55
TT	414 - 420	415.25	419.75	461	56
UU	420 - 426	421.25	425.75	467	57
VV	426 - 432	427.25	431.75	473	58
WW	432 - 438	433.25	437.75	479	59
XX	438 - 444	439.25	443.75	485	60
YY	444 - 450	445.25	449.75	491	61
ZZ	450 - 456	451.25	455.75	497	62
—	456 - 462	457.25	461.75	503	63
—	462 - 468	463.25	467.75	509	64

ULTRABAND CATV FREQUENCY CHART

CHANNEL INDICATOR	BAND	VIDEO CARRIER	AUDIO CARRIER	OSC FREQ
65	468 - 474	469.25	473.75	515
66	474 - 480	475.25	479.75	521
67	480 - 486	481.25	485.75	527
68	486 - 492	487.25	491.75	533
69	492 - 498	493.25	497.75	539
70	498 - 504	499.25	503.75	545
71	504 - 510	505.25	509.75	551
72	510 - 516	511.25	515.75	557
73	516 - 522	517.25	521.75	563
74	522 - 528	523.25	527.75	569
75	528 - 534	529.25	533.75	575
76	534 - 540	535.25	539.75	581
77	540 - 546	541.25	545.75	587
78	546 - 552	547.25	551.75	593
79	552 - 558	553.25	557.75	599
80	558 - 564	559.25	563.75	605
81	564 - 570	565.25	569.75	611
82	570 - 576	571.25	575.75	617
83	576 - 582	577.25	581.75	623
84	582 - 588	583.25	587.75	629
85	588 - 594	589.25	593.75	635
86	594 - 600	595.25	599.75	641
87	600 - 606	601.25	605.75	647
88	606 - 612	607.25	611.75	653
89	612 - 618	613.25	617.75	659
90	618 - 624	619.25	623.75	665
91	624 - 630	625.25	629.75	671
92	630 - 636	631.25	635.75	677
93	636 - 642	637.25	641.75	683
94	642 - 648	643.25	647.75	689
95	648 - 654	649.25	653.75	695
96	654 - 660	655.25	659.75	701
97	660 - 666	661.25	665.75	707
98	666 - 672	667.25	671.75	713
99	672 - 678	673.25	677.75	719
100	678 - 684	679.25	683.75	725
101	684 - 690	685.25	689.75	731
102	690 - 696	691.25	695.75	737
103	696 - 702	697.25	701.75	743
104	702 - 708	703.25	707.75	749
105	708 - 714	709.25	713.75	755
106	714 - 720	715.25	719.75	761
107	720 - 726	721.25	725.75	767
108	726 - 732	727.25	731.75	773
109	732 - 738	733.25	737.75	779
110	738 - 744	739.25	743.75	785
111	744 - 750	745.25	749.75	791
112	750 - 756	751.25	755.75	797
113	756 - 762	757.25	761.75	803

CHANNEL INDICATOR	BAND	AUDIO CARRIER	SOUND CARRIER	OSC FREQ
114	762 - 768	763.25	767.75	809
115	768 - 774	769.25	773.75	815
116	774 - 780	775.25	779.75	821
117	780 - 786	781.25	785.75	827
118	786 - 792	787.25	791.75	833
119	792 - 798	793.25	797.75	839
120	798 - 804	799.25	803.75	845

HRC VHF AND CATV MID BAND FREQUENCY CHART

HRC CHANNEL NUMBER	BAND	VIDEO CARRIER	AUDIO CARRIER	OSC FREQ	CHANNEL INDICATOR
		Low Band VHF			
2	52.75-58.75	54.00	58.50	99.75	2
3	58.75-64.75	60.00	64.50	105.75	3
4	64.75-70.75	66.00	70.50	111.75	4
A-8(4+)	70.75-76.75	72.00	76.50	117.75	00
5	76.75-82.75	78.00	82.50	123.75	5
6	82.75-88.75	84.00	88.50	129.75	6
		Mid Band CATV			
A-2	106.75-112.75	108.00	112.50	153.75	0
A-1	112.75-118.75	114.00	118.50	159.75	1
A	118.75-124.75	120.00	124.50	165.75	14
B	124.75-130.75	126.00	130.50	171.75	15
C	130.75-136.75	132.00	136.50	177.75	16
D	136.75-142.75	138.00	142.50	183.75	17
E	142.75-148.75	144.00	148.50	189.75	18
F	148.75-154.75	150.00	154.50	195.75	19
G	154.75-160.75	156.00	160.50	201.75	20
H	160.75-166.75	162.00	166.50	207.75	21
I	166.75-172.75	168.00	172.50	213.75	22
		High Band VHF			
7	172.75-178.75	174.00	178.50	219.75	7
8	178.75-184.75	180.00	184.50	225.75	8
9	184.75-190.75	186.00	190.50	231.75	9
10	190.75-196.75	192.00	196.50	237.75	10
11	196.75-202.75	198.00	202.50	243.75	11
12	202.75-208.75	204.00	208.50	249.75	12
13	208.75-214.50	210.00	214.50	255.75	13

HRC SUPERBAND AND HYPERBAND CATV FREQUENCY CHART

CHANNEL NUMBER	BAND	VIDEO CARRIER	AUDIO CARRIER	OSC FREQ	CHANNEL INDICATOR
		Superband CATV			
J	214.75-220.75	216.00	220.50	261.75	23
K	220.75-226.75	222.00	226.50	267.75	24
L	226.75-232.75	228.00	232.50	273.75	25
M	232.75-238.75	234.00	238.50	279.75	26
N	238.75-244.75	240.00	244.50	285.75	27
O	244.75-250.75	246.00	250.50	291.75	28
P	250.75-256.75	252.00	256.50	297.75	29
Q	256.75-262.75	258.00	262.50	303.75	30
R	262.75-268.75	264.00	268.50	309.75	31
S	268.75-274.75	270.00	274.50	315.75	32
T	274.75-280.75	276.00	280.50	321.75	33
U	280.75-286.75	282.00	286.50	327.75	34
V	286.75-292.75	288.00	292.50	333.75	35
W	292.75-298.75	294.00	298.50	339.75	36
		Hyperband CATV			
AA	298.75-304.75	300.00	304.50	345.75	37
BB	304.75-310.75	306.00	310.50	351.75	38
CC	310.75-316.75	312.00	316.50	357.75	39
DD	316.75-322.75	318.00	322.50	363.75	40
EE	322.75-328.75	324.00	328.50	369.75	41
FF	328.75-334.75	330.00	334.50	375.75	42
GG	334.75-340.75	336.00	340.50	381.75	43
HH	340.75-346.75	342.00	346.50	387.75	44
II	346.75-352.75	348.00	352.50	393.75	45
JJ	352.75-358.75	354.00	358.50	399.75	46
KK	358.75-364.75	360.00	364.50	405.75	47
LL	364.75-370.75	366.00	370.50	411.75	48
MM	370.75-376.75	372.00	376.50	417.75	49
NN	376.75-382.75	378.00	382.50	423.75	50
OO	382.75-388.75	384.00	388.50	429.75	51
PP	388.75-394.75	390.00	394.50	435.75	52
QQ	394.75-400.75	396.00	400.50	441.75	53
RR	400.75-406.75	402.00	406.50	447.75	54
SS	406.75-412.75	408.00	412.50	453.75	55
TT	412.75-418.75	414.00	418.50	459.75	56
UU	418.75-424.75	420.00	424.50	465.75	57
VV	424.75-430.75	426.00	430.50	471.75	58
WW	430.75-436.75	432.00	436.50	477.75	59
XX	436.75-442.75	438.00	442.50	483.75	60
YY	442.75-448.75	446.00	448.50	489.75	61
ZZ	448.75-454.75	452.00	454.50	495.75	62
AAA	454.75-460.75	458.00	460.50	501.75	63
BBB	460.75-466.75	462.00	466.50	507.75	64

IN CASE OF DIFFICULTY

X-RADIATION PRECAUTION FOR PERSONNEL DURING SERVICING

The only potential source of X-rays in this television receiver are the three picture tubes, which are constructed of materials that reduce X-ray radiation. These tubes will not emit X-rays when the high voltage is at the factory specified level. Refer to the X-ray Precaution Label inside the Television Receiver for the correct measurement procedure. The nominal high voltage is 30 kV.

Begin your search for any trouble that occurs after assembly by carefully following the steps listed below under "Visual Tests." After you complete the "Visual Tests," refer to the Troubleshooting Charts. Start at the first Chart and locate the first condition that best describes the problem you observe. Then perform the tests listed under that condition to determine which module is most likely at fault. When you determine which module is suspected to be faulty, we recommend that you return the module to either the factory or one of the Heath Electronic Centers for exchange. Refer to "Service Facilities" Page 84 for more information.

VISUAL TESTS

1. Recheck the wiring. Trace each lead with a colored pencil on the Pictorial as you check it. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something that you have consistently overlooked.

2. About 90% of the kits that are returned to the Heath Company for repair do not function properly due to poor soldering. Therefore, you can eliminate many troubles by reheating all of your connections to make sure they are soldered as described in Detail 1-1A, in the Illustration Booklet. Be sure there are no solder "bridges" between circuit board foils.

3. Check to be sure all transistors and diodes are in their proper locations. Make sure each lead is connected to the proper point. Make sure that each diode band is positioned above the band printed on the circuit board or as directed in its step.

4. Check electrolytic and tantalum capacitors to be sure their positive (+) or negative (−) mark is at the correct location.

5. Check to be sure that each IC is properly installed in its socket, and that the pins are not bent out or under the IC. Also be sure the IC's are installed in their correct positions.

6. Check the values of the parts. Be sure in each step that you wired the correct part into the circuit, as shown in the Pictorial. It would be easy, for example, to install a 22 kΩ (red-red-orange) resistor where a 2200 Ω (red-red-red) resistor should have been installed. Refer to the "Circuit Board X-Ray Views" (Illustration Booklet, Pages 36 through 46) for the physical location of parts on the circuit boards.

7. Check for bits of solder, wire ends, or other foreign matter which may be lodged in the wiring.

8. Look between each circuit board and the cabinet to be sure all leads were cut off short.

9. A review of the "Circuit Description" may also help determine where the trouble is.

   If you have still not located the trouble after the "Visual Tests" are completed, and a voltmeter is available, check voltage readings against those shown on the Schematic Diagrams. Read "Precautions for Troubleshooting" before you make any measurements. NOTE: All voltage readings were taken with a high input impedance voltmeter. DC voltages and resistances may vary as much as ±20%. AC voltages may vary much more depending upon the meter and the way you have the leads connected. NOTE: The readings indicated in the test charts were taken with a Heathkit Model IM-5217 VOM.

Alignment waveforms are shown on Pages 34 and 35 of the Illustration Booklet, for reference.

PRECAUTIONS FOR TROUBLESHOOTING

Be sure you do not short any terminals to ground when you make voltage measurements. If the probe should slip, for example, and short across components or voltage sources, it is very likely to cause damage to one or more transistors or diodes.

In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of this Manual. Your Warranty is inside the front cover.

NOTE: The horizontal shutdown circuitry may be activated during troubleshooting procedures. To restart it, press the Power switch.

TROUBLESHOOTING CHARTS

The following charts list the "Condition," "Test," and "Possible Cause" of some possible malfunctions. Under some of the conditions you will find several tests you can make. These tests should help you narrow down the problem to a specific module or in some cases a specific part. If you isolate a problem to a specific module, first be sure all the connections to it are correct; then refer to "Service Facilities" on Page 84. If a particular part or parts are mentioned (transistor Q901, for example, or connector 5G4 pin 5) as a possible cause, to see that it is properly installed at the correct location. It is also possible, on rare occasions, for a part to be faulty.

NOTES:

1. For some of the tests in these charts you will need an ohmmeter to make resistance tests and a voltmeter to make voltage measurements. Use either a VOM (volt ohmmeter), a VTVM (vacuum tube voltmeter), or a DVM (digital voltmeter).

2. When you are directed to make an ohmmeter measurement, be sure to unplug the line cord of the TV set. Also, we recommend that you unplug the line cord whenever you connect or disconnect the voltmeter.

3. Since several circuit modules are involved in some of the troubleshooting tests, the Pictorial numbers will not be called out each time. The modules will be referred to by name and will correspond to the following Pictorials:

4. When you disconnect a cable connector from a module plug, rock the connector from end-to-end while you pull up on it. DO NOT rock the connector from front-to-back; otherwise, you could bend the contacts inside the connector and cause them to make intermittant contact with the plug pins.

Overall TV set ..... Pictorial 6-1

Control assembly ..... Pictorial 6-2

Tuner Control module ..... Pictorial 6-3

VHF/UHF Tuner module ..... Pictorial 6-4

Focus module ..... Pictorial 6-5

Infrared Detector assembly ..... Pictorial 6-6

Light Sensor and Stereo LED assembly . Pictorial 6-7

Video IF module ..... Pictorial 6-8

Video Output module ..... Pictorial 6-9

Chroma/Luminance module ..... Pictorial 6-10

Sweep module ..... Pictorial 6-11

Switch Mode Power Supply module . Pictorial 6-12

Raster Registration module ..... Pictorial 6-13

Audio/Video Isolation module .... Pictorial 6-14

Stereo Decoder module ..... Pictorial 6-15

Stereo IF module ..... Pictorial 6-16

Stereo Interface module ..... Pictorial 6-17

Stereo Amplifier module ..... Pictorial 6-18

Crosshatch circuit board ..... Pictorial 6-19

Remote Control Transmitter ..... Pictorial 6-20

Keyboard ..... Pictorial 6-21

To use the following charts, first find the condition that best describes your TV's symptoms. Then perform each test in the "Test" column for that symptom. When you find a test that does not produce the indicated results, refer to the items listed under "Possible Cause."

NOTE: This TV Set has two separate ground systems; a DC ground and an AC ground. The DC ground is located at the tuner support bracket and is identified on the schematics as ⏚ . This ground is routed through the heavy black wire from the tuner support bracket to the switch mode power supply.

The AC ground is located at the large heat sink on the switch mode power supply. it is identified on the schematics as ⏚ .

Do not touch this heat sink, as there is voltage present on it. Also do not connect the two ground systems together, as they are at different potentials.

CAUTION: DO NOT UNPLUG any connectors while the TV set is turned on unless you are instructed otherwise. To do so may damage the picture tubes.

CONDITION	TEST	POSSIBLE CAUSE
Receiver does not turn on. No picture or sound.		
	1. Listen for a faint hum coming from the switch mode power supply transformer.	A. Line cord not plugged into AC outlet. B. Fuse FX3401.
	2. Unplug the line cord from the AC outlet. After about two seconds, you should hear a single popping sound from the speakers. Plug the line cord back into the AC outlet and you should hear another pop from the speakers.	A. Fuse FX3401. B. Fuse FX3402 (labeled FX2 on module).
	3. Unplug connector 4E3 on the switch mode power supply module and measure the voltage at module plug 4E3 pin 2 for 147 VDC. Then reconnect 4E3.	A. Problem on the switch mode power supply module.
	4. Measure the voltage at connector 4E3 pin 2 for 147 VDC.	A. Problem on the sweep module. B. Problem on raster registration module.
	5. Unplug connector 4P6 on the switch mode power supply module and measure the voltage at plug 4P6 pin 2 for 12 VDC. Then reconnect 4P6.	A. Problem on the switch mode power supply module.
	6. Measure the voltage at connector 4P6 pin 2 for 12 VDC.	A. Problem on the tuner control module.
	7. Measure the voltage at connector for 1.7 VDC.	A. Problem on the tuner control module.
No picture. Screen is black. Hissing sound is present.		
	1. Measure the voltage at chroma/luminance module connector 2A4 pin 4 for 12 VDC.	A. Problem on the chroma/luminance module.
	2. Measure the voltage at tuner control module connector 6K3 pin 5 for 12 VDC.	A. Problem on the tuner control module. B. Open connection between tuner control module connector 6K3 and sweep module connector 3N.

CONDITION	TEST	POSSIBLE CAUSE
No picture. Screen is black except for time/ channel display. Sound ok.		
	1. Measure the voltage at chroma/luminance module connector 2D7 pin 1 for between 0 and 12 VDC (depending on the setting of the Black Level and Black Level Range controls).	A. Problem on the chroma/luminance module. B. Connector 2D7 has an open circuit.
Screen is black but high voltage is present (a crackling sound from the picture tubes when the set is turned on and off indicates that the high voltage is present).		
	1. Check to make sure the audio/video panel speakers switch is set to TV.	
	2. Look for the filament glow inside the neck of each picture tube. If you see a glow, proceed to Test 5.	
	3. Unplug video output module connector 5C and measure the resistance between the cable terminals for 5 Ω.	A. Problem on the sweep module.
	4. Measure the resistance on the blue video output module between the 5C connectors at pins 1 and 2 for 2Ω.	A. Open connector 5C on the red, green, or blue video output module. B. Red, green, and/or blue video output module(s) not making contact with picture tube plug pins.
	5. Measure the voltage at tuner control module connector 6K3 pin 5 for 12 VDC.	A. Tuner control module. B. Sweep module. C. Switch mode power supply module.
	6. Measure the voltage at tuner control module connector 6A9 for 5 VDC.	A. Tuner control module.
	7. Measure the voltage at red video output module connector 5B pin 1 for 250 VDC.	A. Open 5B/5H cable from the red video output module to the focus control module.
	8. Measure the voltage at sweep module connector 3B (3B5 on the sweep module) pin 2 for 250 VDC.	A. Sweep module.
	9. Measure the voltage at red video output module connector 5B pin 3 for 35 VDC.	A. Focus control module.

CONDITION	TEST	POSSIBLE CAUSE
Dimly lit screen. Brightness varies with the Picture and Black Level controls. The time/channel display is present on the screen and the sound is normal.		
	1. Measure the voltage at chroma/luminance module connector 2E7 pin 3 for between 0 and 11 VDC (depending upon the setting of the Picture control).	A. Problem with IC2351 on the chroma/luminance module. B. Problem on the top control panel.
	2. Measure the voltage at chroma/luminance module connector 2C pin 6 for 5.8 VDC.	A. Open connection between chroma/luminance connector 2C and video IF module connector 1B. B. Video IF module. C. Chroma/luminance module.
Bright screen with little or no picture. Picture and Black Level controls have no effect.		
	1. Measure the voltage at green video output module connector 5B for 250 VDC.	A. Focus control module. B. Sweep module.
	2. Measure the voltage at green video output module connector 5B pin 5 for approximately 950 VDC. NOTE: This is a high impedance circuit and your meter may load it down, so the voltage is somewhat less than what is actually present.	
	3. Measure the voltage on the heat sinks of transistors Q5226 on the red, green, and blue video output modules for 190 VDC.	A. Video output module(s).
Brightly lit screen. Bright diagonal lines. No time/channel display. Picture and Black Level controls have no effect. Hissing sound from speakers.		
	1. Measure the voltage at chroma/luminance module connector 2A4 pin 3 for 12 VDC.	A. Sweep module.
	2. Measure the voltage at tuner control module connector 6K3 pin 1 for 25 VDC.	A. Open connection between tuner control module connector 6K3 and sweep module connector 3N. B. Tuner control module. C. Sweep module.

CONDITION	TEST	POSSIBLE CAUSE
No vertical deflection. A line is visible across the center of the screen. NOTE: Do not allow this condition to continue or the phosphor of the picture tubes will burn. Turn the Picture and Black Level controls down.		
	1. Measure the voltage at chroma/luminance module connector 2G8 pin 1 for 30 VDC.	A. Chroma/luminance module.
	2. Measure the voltage at chroma/luminance module connector 2G8 pin 4 for 62 VDC.	A. Chroma/luminance module. B. Sweep module.
	3. Measure the voltage at raster registration module connector 8H pin 3 for 30 VDC.	A. Raster registration module. B. Open red, green, or blue vertical yoke winding.
No vertical sync. Picture rolls vertically.		
	1. Measure the voltage at video IF module connector 1B pin 2 for 1.2 VDC.	A. Video IF module. B. Chroma/luminance module. C. Open connection between video IF module conector 1B and chroma/luminance module connector 2C.
Snow on screen and no picture. Time/channel display present. Hissing sound from speakers.		
	1. Unplug tuner module connector 1K6 and measure connector 1K6 hole 4 for 25 VDC. Then reconnect IK6.	A. Open connector 1K6 and tuner control module connector 6M1. B. Tuner defective.
	2. Measure the voltage at tuner control module connector 6K3 pin 1 for 25 VDC.	A. Sweep module. B. Open cable 6K3 and sweep module connector 3N.
	3. Measure the voltage at tuner control module connector 6K3 pin 4 for −50 VDC.	A. Tuner control module. B. Sweep module.
Picture normal, no sound.		
	1. Make sure the Speaker switch on the audio/video panel is at the Internal position.	
	2. Measure the voltage at stereo amplifier module connector 8E7 pin 2 for 25 VDC.	A. Sweep module.
	3. Measure the voltage at stereo amplifier module connector 8P pin 2 for 35 VDC.	A. Switch mode power supply module.

(CONTINUED)

CONDITION	TEST	POSSIBLE CAUSE
	4. Touch stereo amplifier module connecotr 8F4 pin 1 and then pin 3 with the blade of a small screwdriver. You should hear hum from the speakers	A. Stereo amplifier module.
	5. Place the stereo Source switch in the AUX position. Then touch stereo decoder module connector 4E9 pin 1 and then pin 3 with the blade of a small screwdriver. You should hear hum from the speakers.	A. Stereo decoder module.
	6. Measure the voltage at stereo amplifier module connector 8E7 pin 2 for 26 VDC.	A. Stereo interface module.
TV operates normally. Video input/loop output jacks inoperative.		
	1. Measure the voltage at audio/video isolation module connector 4J8 pin 3 for 25 VDC.	A. Sweep module.
	2. Measure the voltage at audio/video isolation module connector 1S pin 3 for 13 VDC.	A. Audio/video isolation module.
TV operates normally. Stereo audio input/ loop output jacks inoperative.		
	1. Measure the voltage at stereo decoder module connector 4A1 pin 2 for 12 VDC.	A. Stereo decoder module. B. Stereo interface module.
	2. Measure the voltage at stereo interface module connector 8D3 pin 3 for 25 VDC.	A. Sweep module.
	3. Measure the voltage at stereo amplifier module connector 8E7 pin 2 for 25 VDC.	A. Sweep module.
	4. Measure the voltage at stereo amplifier module connector 8P pin 2 for 35 VDC.	A. Switch mode power supply module.
	5. Both steps 3 and 4 checked Ok.	A. Stereo amplifier module.

Keyboard Problems

This section shows you how to troubleshoot various keyboard-related problems. Before you begin your search for a channel-change problem, be sure you have correctly entered the channel number change. Wait until the time/channel display disappears. Then press the ENTER key and note the channel number that is displayed. It should indicate the channel number that you entered. If it does not, first refer to the "Operation" section of this Manual (Page 52) to make sure you are operating the Keyboard correctly.

Tables 6-1 and 6-2 indicate the correct voltages that are required to tune the various bands. LO VHF (channels 2 through 6) and HI VHF (channels 7 through 13) are the same for either normal operation or CATV operation.

Table 6-1

Connector DC voltages with BAND switch at VHF/UHF.

Band	Channel	Connector				
		6M1 PIN 4 OR 1L1–1K6 PIN 2	6L1 PIN 1 OR 1J6 PIN 4	6L1 PIN 3 OR 1J6 PIN 2	6L1 PIN 2 OR 1J6 PIN 3	6M1 PIN 3 OR 1L1–1K6 PIN 3
LO VHF	2 — 6	– 24	1 — 10	12	– 23	1 — 10
HI VHF	7 — 13	+ 10	11 — 25	12	– 20	11 — 25
UHF	14 — 69	+ 10	1 — 28	2	– 20	1 — 28

Table 6-2

Connector DC voltages with BAND switch at NORM.

(For CATV mid-band and SUPER/HYPER band channels only. Channels 2 through 13 are the same as in Table 6-1.)

Band	Channel	Connector				
		6M1 PIN 4 OR 1L1–1K6 PIN 2	6L1 PIN 1 OR 1J6 PIN 4	6L1 PIN 3 OR 1J6 PIN 2	6L1 PIN 2 OR 1J6 PIN 3	6M1 PIN 3 OR 1L1–1K6 PIN 3
MID	0, 1, 14 — 22	11	.5 — 9	12	– 20	.5 — 9
SUPER & HYPER	23 — 41	10	2 — 12	12	+ 10	1 — 12

If any voltage is incorrect, you can unplug the corresponding connector so that you can determine if the problem is on the tuner control module or in the UHF/VHF tuner.

If the BAND switch and supply voltages are correct but the tuning voltage does not vary (change when you select other channels), the problem could simply be an improperly connected cable between the UHF/VHF tuner and the tuner control module.

You can use an oscilloscope to observe the signal at the output of the prescaler.

When the tuning voltage is fixed at approximately 1 volt DC, the output of the prescaler on all bands is about 1 volt peak-to-peak. The prescaler is the tuner oscillator frequency that is required to tune the channel, divided by 64. The following chart shows the relationship between the tuner oscillator frequency and the prescaler output frequency.

Band	Tuner Oscillator Frequency (MHz)	Prescaler Output Frequency
LO VHF	101 CHANNEL 2	1578.13 kHz
HI VHF	221 CHANNEL 7	3.45313 MHz
UHF	517 CHANNEL 14	8.07813 MHz

The keyboard circuit board uses a 5 by 8 matrix arrangement as shown in Tables 6-3 and 6-4. For example, when you push the 7 key, connector 6A6 pin 2 makes contact with connector 6C6 pin 2.

Table 6-3
Keyboard matrix.

CONNECTOR	6A6 PIN 5	6A6 PIN 4	6A6 PIN 3	6A6 PIN 2	6A6 PIN 1
6C6 PIN 1	0	1	2	3	POWER
6C6 PIN 2	4	5	6	7	
6C6 PIN 3	8	9			
6C6 PIN 4	ENTER	STEREO MONO SAP.		SKIP	
6B6 PIN 1		CHAN DOWN	VOL DOWN		
6B6 PIN 2	MIN	HR			
6B6 PIN 3	TIME RECALL	CHAN UP	VOL UP		
6B6 PIN 4		ANT 1,2,3,4	Parental Control		

Table 6-4
Control panel switch "MAKE" connections.

CONNECTOR	6D6 PIN 1
6D6 PIN 4	VHF/UHF
6D6 PIN 3	CATV HRC
6D6 PIN 2	AFC SPCL

The following troubleshooting chart lists some possible keyboard-related problems. You can verify keyboard problems by operating the set with the remote control transmitter.

CONDITION	TEST	POSSIBLE CAUSE
Single key in Table 6-3 does not operate.		
	1. Unplug connectors 6A6, 6B6, and 6C6 from the tuner control module.	
	2. Measure the resistance between the connector pins that correspond to the inoperative key. (If key 4 is inoperative, for example, measure the resistance between connector 6C6 pin 2 and connector 6A6 pin 5. The resistance should be 10 Ω when you depress the key.) NOTE: If the key checks okay with the ohmmeter, the problem is on the tuner control module.	A. Defective keyboard.
AFC switch does not operate.		
	1. Unplug connector 6D6 from the tuner control module. Then measure the resistance between connector 6D6 pins 1 and 2. You should measure 0 Ω with the AFC switch at SPCL and infinity with the switch at NORM. NOTE: If you have the correct resistance readings, the problem is on the tuner control module.	A. Defective switch.
Band switch does not operate.		
	1. Unplug connector 6D6 from the tuner control module. Then measure the resistance between connector 6D6 pins 1 and 4. You should measure 0 Ω with the Band switch at UHF/VHF and infinity with the switch at CATVNORM. You should measure 0 Ω between pins 1 and 3 with the Band switch in the CATV HRC position. NOTE: If you have the correct resistance readings, the problem is on the tuner control module.	A. Defective switch.
Power key does not operate.		
	1. Unplug connector 6C6 and 6A6 from the tuner control module. Then measure the resistance between connector 6C6 pin 1 and 6A6 pin 1. You should measure 10 Ω with the key down and infinity with the key up. NOTE: If you have the correct resistance readings, the problem is on the tuner control module.	A. Defective keyboard.

Remote Control Problems

NOTE: The following information assumes that the top panel keyboard operates properly. If you have a problem on the top panel keyboard, refer to "Keyboard Problems" and correct the problem before you attempt to troubleshoot the remote control.

CONDITION	TEST	POSSIBLE CAUSE
Remote control does not operate at all.		
	NOTE: Connect the common voltmeter lead to the tuner support bracket when you make voltage measurements.	
	1. Unplug connector 6H6 from the tuner control module. Then measure the voltage at connector 6H6 pin 3 on the tuner control module. You should measure 12 volts DC. Reconnect 6H6.	A. Problem on the tuner control module.
	2. Disconnect the plug from the infrared sensor. Measure the voltage at pin 3 of the infrared sensor connector (yellow wire). You should measure 12 volts DC.	A. Open connection between pin 3 of the infrared sensor assembly connector and connector 6H6 pin 3 on the tuner control module.
	3. Reconnect the connector to the infrared sensor assembly. Be sure the white wire is away from the cabinet side. Then again measure the voltage at pin 3 of the connector (yellow wire). You should measure 12 volts DC.	A. Problem in the infrared sensor assembly.
	4. Measure the DC voltage at pin 2 of the infrared sensor assembly connector (violet wire). You should measure 0 volts DC. Hold the transmitter near and facing the window of the infrared sensor assembly (on the front panel). Press any key on the transmitter and again measure the voltage at pin 2 of the infrared sensor assembly connector (violet wire). You should now measure .1 volt DC (pulsating).	A. Problem in the infrared sensor assembly. B. Problem in the infrared sensor assembly or the remote transmitter.
	5. Remove the battery cover from the remote transmitter and remove the battery. Then measure the voltage across the battery terminals. You should measure 6 volts DC.	A. Battery. (Refer to the "Parts List" on Page 21 for battery replacement part number.)

Crosshatch Problems

The following information concerns problems that are related to the crosshatch module. TV operates normally.

CONDITION	POSSIBLE CAUSE
Very bright white screen when you switch SW901 to Crosshatch position.	A. Open red wire (+25 V) between resistor R10 on the stereo interface module and hole F on the crosshatch circuit board. B. Resistor R921. C. Diode D905. D. Capacitor C904. E. Transistor Q905.
White screen level varies when you adjust the crosshatch control (R911).	A. Integrated circuit U901, U902, or U903.
Vertical lines are okay; no horizontal lines.	A. Open green wire (12 V peak-to-peak) between resistor R2206 on the chroma/luminance module and hole E on the crosshatch circuit board. B. Transistor Q904. C. Integrated circuit U901 or U902. D. Diode D901.
Horizontal lines are okay; vertical lines are slanted.	A. Transistor Q903. B. Integrated circuit U903.
Diagonal dot pattern on the screen.	A. Open white wire between VERT HIGH stake on the chrome/luminance module and hole C on the crosshatch circuit board. B. Integrated circuit U901 or U902. C. Transistor Q901.
Dots appear in crosshatch pattern.	A. Transistor Q902. B. Integrated circuit U903.
Horizontal lines are okay; no vertical lines.	A. Transistor Q901, Q902 or Q903. B. Integrated circuit U901 or U903. C. Diode D902.
Black screen.	A. Transistors Q901, Q904, or Q905. B. Integrated circuit U901. C. Open yellow wire between COMB LUM stake on the chrome/luminance module and hole A on the crosshatch circuit board.

GENERAL MAINTENANCE

CLEANING THE SCREEN

1. Make sure the TV Set is turned off.

2. Use the antistatic, dust-repellent Brillianize Cleaner and Polisher provided with your TV Set to remove finger prints and nonabrasive dirt from the screen. Two Kleenmaster Sofcloths are provided.

3. Shake the container well before you use the cleaner.

4. Spray a liberal amount of the cleaner on a piece of the Sofcloth (DO NOT SPRAY IT DIRECTLY ON THE SCREEN). Also, do not allow the cloth to become saturated with the cleaner.

5. Spread the cleaner over the entire screen surface in long, vertical strokes without applying too much pressure.

6. When the screen is thoroughly covered and before it dries, buff the surface of the screen to a slippery glaze with the cloth, using long, vertical strokes. NOTE: Surfaces buffed to a high glaze are more resistant to dust, scratches, and fingerprints.

To clean the Sofcloths, use clean water, rinse, and then let dry.

CAUTION: Do not use abrasive cleaners, furniture polish, wax, window or other cleaners that might leave residue on the screen surface.

To reorder the Brillianize Cleaner Kit, use Heath Company part number 235-713.

CLEANING THE PROJECTION LENSES

To minimize the possibility of scratching the lenses, do not use any dry material to clean them (dry cloth, lens cleaning tissue, etc.). Do not spray any type of fluids directly against the lens surfaces.

To clean the projection lenses, use a solution of distilled water and a few drops of mild detergent sprayed on a piece of clean, soft tissue paper. Then lightly wipe the surface of the lens until it is clean.

CLEANING THE MIRROR

To clean the mirror, use a solution of 10% isopropyl alcohol and 90% distilled water. Spray a soft cloth with the solution and clean the surface. Allow the surface to air dry.

SERVICE FACILITIES

Heath Company, a subsidiary of Zenith Electronics Corporation, provides you with several services. These services include our Technical Consultation, Parts, and Service Departments, each of which is outlined below. In addition to these services, we have included for your convenience a separate Zenith Replacement Parts List so you can obtain separate components for your television set if you desire.

During the Warranty period of your television, you can exchange modules (preassembled and factory aligned circuit boards) through the Heath Factory, or your nearest Heath/Zenith Computers & Electronics Center. **Warranty service is available only through the Heath factory or a Heath/Zenith computers & electronics center.**

AFTER WARRANTY, you may exchange modules at reasonable rates through the Heath Factory or a Heath/Zenith Computers & Electronics Center. You may also elect to obtain replacement components for the preassembled modules through a local authorized **Zenith Service Center. These individual parts are not available from the Heath Company or the Heath/Zenith Computers & Electronics Centers.**

REPLACEMENT PARTS

Please provide complete information when you request Heath replacement parts from either the factory or Heath/Zenith Computers & Electronics Centers. Be certain to include the **HEATH** part number exactly as it appears in the Parts List.

Ordering From the Factory

Print all the information requested on the parts order form furnished with this product and mail it to Heath Company. For telephone orders (Heath parts only) dial (616) 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location where purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by the warranty.

Mail letters to: Heath Company
Benton Harbor, MI 49022
Attn: Parts Replacement Dept.

Retain the original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

Obtaining Replacement Parts From A Heath/Zenith Computers & Electronics Center

For your convenience, "over the counter" Heath replacement parts are available from the Heath/Zenith Computers & Electronics Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath/Zenith Computers & Electronics Center.

TECHNICAL CONSULTATION

Need help with your kit? – Self-Service? – Construction? – Operation? – Call (616)982-3307 or write for assistance. You'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number (from the blue and white label).
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.
- The complete Manual number.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

HINTS: Telephone traffic is lightest at midweek. Please be sure your Manual and notes are on hand when you call us.

Heath/Zenith Computers & Electronics Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, or soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heath/Zenith Computers & Electronics Center. For warranty service, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. Do not include the kit Manual. Place the equipment in a strong carton with at least THREE INCHES of resilient packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions, such as knobs. If the unit weighs over 15 lbs., place this carton in another carton with at least 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

CIRCUIT BOARD MODULE SERVICE POLICY

This color TV receiver was designed to give maximum performance with utmost service simplicity. To help you service your Set, it is sectionalized into circuit boards, or "modules." You can remove any one of these modules for inspection or service.

This Manual contains troubleshooting procedures to help you isolate troubles to specific modules. Also, our trained technical staff will assist you by letter or telephone in troubleshooting your Set to the "module level."

SPECIAL SERVICE FACILITY

Special service facilities have been established at our Heath/Zenith Computers & Electronics Centers and factory to exchange TV circuit board modules*. After you have isolated the problem to a particular module(s), you may return the module(s) for exchange under this policy. **Do not mail** the module to a Heath/Zenith Computers & Electronics Center. You may, however, either take the module(s) to the Center or mail it directly to the factory.

MODULE SERVICE

In Warranty — If a module proves defective during the 90-day warranty period, the factory-assembled modules will be exchanged with no charge for parts or labor. If the problem is due to a construction error that you have made (improper cable connections, etc.), there will be a service charge. Customer-assembled circuit boards will be serviced rather than exchanged.

Out of Warranty — After the standard 90-day warranty expires, any of the modules that require service and are returned to a Heath service facility will be exchanged or serviced at an established rate.

HOW TO RETURN MODULES

Pack the module(s) carefully in a suitable carton.** Be sure to use plenty of packing material to protect the module(s). Include the following information in the pack:

1. A letter describing the symptoms observed in your TV Set.
2. The Model number (refer to the blue and white label).
3. The location, date of purchase, and invoice number.
4. Your complete return address.

Ship the carton by insured parcel post, or UPS, to "Heath Company, Benton Harbor, Michigan 49022, Attn: Service Department."

The above service policy applies only to modules. If a problem appears to be somewhere other than on one of the modules, please check with your nearest Heath/Zenith Computers & Electronics Centers, or our Technical Consultants before you return the Set for service.

* Factory-assembled modules only.

** NOTE: If it should ever become necessary to return the sweep module for service, first repack it in its original carton and packing material before you place it in this "suitable carton."

PICTURE TUBE AND OPTICAL COUPLING PAD REPLACEMENT

SCREEN AND CABINET BACK REMOVAL

Refer to Pictorial 7-1 for the following steps.

1. Remove the cabinet back from the cabinet.
2. Unsnap the screen frame from the front of the cabinet.
3. Remove the four screen mounting brackets from the cabinet and lift the screen from the slot in the bottom of the cabinet.

OPTICAL COUPLING PAD REPLACEMENT

Refer to Pictorial 7-2 for the following steps.

1. Remove the four mounting screws from the picture tube lens of the optical coupling pad you wish to replace.
2. Remove the picture tube lens from the CRT chassis.
3. Peel the optical coupling pad from the picture tube.

NOTE: If you are installing a replacement CRT, proceed to "Picture Tube (CRT) Replacement." If you are only replacing the optical coupling pad, proceed to the next step.

4. Follow the instructions on the instruction sheet supplied with your new optical coupling pad and install the new pad on the CRT.
5. Remount the picture tube lens to the chassis using its mounting hardware.

Refer to Pictorial 7-1 for the following steps.

6. Reinstall the screen and the four screen mounting brackets on the cabinet.
7. Reinstall the screen frame on the cabinet.

PICTURE TUBE (CRT) REPLACEMENT

Refer to Pictorial 7-3 for the following steps.

1. Unplug the video output module from the CRT you wish to replace and position it out of the way.

2. Loosen the collar on the deflection yoke and slide the yoke from the neck of the CRT. Position it out of the way.

3. Disconnect the anode lead coming from the CRT you wish to replace from the focus control assembly. Be careful not to touch the metal tip of the anode lead.

WARNING: Due to the large surface area and high vacuum, handle the CRT with extreme care. Do NOT strike, scratch, or subject the CRT to more than moderate pressure at any time. Never lift the CRT by its neck. A fracture of the glass could result in an implosion of considerable violence capable of causing serious personal injury. When you handle the CRT, be careful not to touch the bare metal anode lead end, since you could receive a severe electrical shock.

IMPORTANT: Do not set the CRT down so that any part of its weight rests on the neck. If you must set it down, always set it face down on a soft cloth until you install it.

4 Remove the four mounting screws holding the CRT to the chassis. Then carefully lift the CRT from the chassis and set it aside. NOTE: The CRT can accumulate a charge once you disconnect it from the circuit. To dischage the CRT, touch the metal tip of the anode lead against the metal CRT cowl for a moment. DO NOT touch the metal tip with your fingers.

5. Open the CRT carton by following the instructions on the outside. Carefully remove the replacement CRT from the carton and discharge the CRT as you did in the previous step.

6. Remove the warranty cards, fill them out, and keep them in a safe place in case you need to refer to them later.

7. Check for a plastic film over the face of the CRT. If one is installed, remove and discard it.

8. Install the new optical coupling pad on the new CRT as directed in the instruction sheet supplied with the optical coupling pad kit.

9. Position the CRT anode lead as shown in the Pictorial and center the CRT over the chassis opening. Then mount the CRT to the chassis with the screws you removed earlier, tightening the screws in the sequence shown in the Pictorial. Make sure you reinstall the ground strap at the indicated mounting screw location.

10. Reinstall the deflection yoke on the neck of the CRT and push it firmly against the back of the tube. Then position the yoke as shown in the Pictorial and tighten the collar screw until it is just snug enough to hold the yoke in place.

11. Reinstall the anode lead coming from the CRT into the focus control assembly hole and twist the round nut 1/4 turn to lock it in place.

12. Reinstall the video output module on the CRT base so the socket is over the plug as far as it will go.

13. Dress the leads as shown in Pictorials 2-12 and 2-13.

Proceed to the "Adjustments and Alignment" section of this Manual to align the Set.

INSTRUMENT ALIGNMENT

Instrument realignment of this TV Set is not normally required. The following information is provided in case realignment is needed at some future time due to parts replacement.

WARNING: Do not attempt to align this TV set unless you have had previous TV alignment experience, a thorough knowledge of the theory involved, and the necessary equipment.

NOTE: Clockwise (CW) or counterclockwise (CCW) means the direction of rotation as viewed from the knob end of the control.

VIDEO IF ALIGNMENT

Refer to Pictorial 8-1 for the locations of the test points and adjustments on the video IF module.

NOTE: To perform the following steps, we recommend you use a matching pad as shown in Detail 8-1A between your generator and the circuit test points.

( ) With no signal applied, use an external DC voltage source to set the bias at the IF AGC test stake to +6 volts.

( ) Connect the positive lead of your voltmeter to test stake C1 and the negative lead to the ground post.

( ) Adjust the ZERO CARRIER control (R1228) for a +6.6 volts DC indication on the voltmeter.

( ) Select channel 12 or channel 13.

( ) Set the external DC voltage at the IF AGC test stake to +2 volts.

( ) Connect an RF sweep generator to the tuner injection test point A.

( ) Connect the oscilloscope demodulator probe to the bandpass test stake on the IF module and set the IF sweep generator input level for 3.3 volts peak on the oscilloscope.

( ) Adjust the maximum gain coil (L1205) so the 45.75 MHz marker is as close as possible to the peak of the response curve. See Detail 8-1B for a typical RF/IF response curve.

( ) Increase the input sweep level by 44 dB (158 times) and reset the external bias voltage for 3.3 volts peak on the oscilloscope. NOTE: The bias voltage will be about +5 volts DC.

( ) Refer to Detail 8-1C and adjust the tuner IF amplifier coil (L128) so the 45.75 MHz marker is as close as possible to the peak of the response curve.

( ) Increase the input signal by 20 dB (10 times) and adjust the sound shelf trap coil (L1204) so the 41.25 MHz marker is at 80% as shown in Detail 8-1D. Note that the trap indentation is left of the 41.25 MHz marker.

( ) Decrease the input signal by 20 dB. Then disconnect the demodulator probe from tuner injection test point A and connect a low capacitance oscilloscope probe to test stake C1 on the IF amplifier.

( ) Refer to Detail 8-1E and adjust the oscillator coil (L1203) as necessary until the signal is "locked" (no oscillations) over the right half of the response curve.

( ) Adjust the external bias so the 45.75 MHz marker is at 50% as shown in Detail 8-1F. Then adjust the limiter coil (L1229) so the 45.75 MHz marker is as close as possible to the peak of the response curve.

( ) Connect the oscilloscope probe to test point C2 (pin 9 of IC 1201). The response curve should be the same as you observed at test point C1.

( ) Move the oscilloscope probe back to test stake C1. If the 45.75 MHz marker is not at 50% of the response curve, adjust the external bias voltage until it is.

( ) Connect the oscilloscope probe to the AFC output test point (the indicated lead of 220 Ω resistor R1230).

( ) Refer to Detail 8-1G and adjust the AFC coil (L1226) so the 45.75 MHz marker is slightly above the base line on the right negative-going slope of the waveform as shown.

( ) Disconnect all of your equipment from the TV Set and connect an antenna to the terminals on the back of the Set.

( ) Select a strong station. Then measure the voltage at the AFC output test point (approximately +3 volts).

( ) Slide the AFC switch on the top front panel back and forth between SPCL and NORM and observe the meter indication. If the voltage varies more than 0.1 volt, adjust AFC coil #1 (L1226) until the readings are the same (within 0.1 volt).

( ) Connect the voltmeter probe to the APC test point (the indicated lead of resistor R1201). NOTE: You can gain easy access to this test point through a hole in one of the bottom covers as shown in the inset drawing on the Pictorial.

( ) Adjust the oscillator coil (L1203) for +5.2 volts on the voltmeter. Be sure the AFC switch on the top front panel is at NORM.

NOTE: The following three steps will provide proper RF AGC action.

( ) Select a strong, snow-free station.

( ) Turn the AGC DELAY control (R1353) counterclockwise until you observe snow in the picture. Then turn the control clockwise until you obtain a good snow-free picture.

( ) Check other weak stations and readjust the control as necessary.

AUDIO CIRCUIT

( ) Select a strong station.

( ) Adjust the sound IF detector coil (L1451) for minimum buzz and the best sound.

( ) Select a weak station.

( ) Adjust the sound IF input coil (L1452) for maximum sound output from the speakers.

HEIGHT RANGE

To change the adjustment **range** of the HEIGHT control, unplug the shorting bar at 2M on the chroma/luminance module and plug it back over the other two circuit board pins.

VERTICAL MODE

To "force" the vertical circuit to operate in the non-standard mode, unplug shorting bar 2K on the chroma/luminance module and turn it 90°; then plug it back over the circuit board pins. Use this position only for sources which have erratic vertical sync pulses, such as TV games, computers, or VCR's operating in the "special effect" modes.

COLOR APC

1. Select a weak antenna signal.

2. Switch the Color Sentry off.

3. Set the top front panel TINT control to the center of its rotation.

4. Set the COLOR control clockwise.

5. Unplug setup jumper 2J on the chroma/luminance module from its NORMAL position, rotate it 90°, and plug it over its SETUP position pins.

6. Adjust the chroma/luminance module APC Adjust control (R2331) slowly until the color bars become wider and fewer in number. Adjust the control until the entire picture is predominantly one color. The color may drift slowly from red to green to blue.

7. Return jumper 2J to its NORMAL position.

8. Turn the Set off.

This completes the "Instrument Alignment."

IMPROVING NOISE IMMUNITY

NOTE: Perform the following step to improve the noise immunity in a fringe or noisy reception area.

( ) Refer to Pictorial 8-1 and install a jumper wire across resistor R1330 on the video IF module. Holes are provided in the circuit board for this purpose.

ADJUSTING THE MASTER SCAN OSCILLATOR

You can adjust the frequency of the master scan oscillator. Refer to Pictorial 8-1 and short pin 3 of IC1351 to ground. Then, while you observe the screen, adjust the core of the frequency adjustment coil L1376 for a zero beat (slowest roll of the picture) for the horizontal and vertical oscillators.

CIRCUIT DESCRIPTION

Refer to the Interconnect Diagram, the various Schematic Diagrams, and the Block Diagrams while you read the following Circuit Description. Circuit components are identified with a combination letter-and-number callout. The letter describes the component; the number locates it in the TV Set and on the Schematic.

TUNER MODULE

Refer to the Tuner Module Schematic Diagram while you read the following section.

VHF SECTION

The signal is routed to the VHF section of the tuner by reverse- biasing diodes CR1 and CR2. After trapping the FM band and IF passband, it is tuned by varactor diode CR103 and inductors L102, L104, L106, L107, and L103 for low, high, super, and hyperband operation. The signal is then amplified by dual-gate MOSFET transistor Q3 and coupled through a double-tuned matching circuit consisting of varactor diodes CR104 and CR109, and inductors L1112, L1113, L1114, and L1116 to the mixer stage at transistor Q4. At this point, the selected and amplified signals are heterodyned with the signal from oscillator transistor Q6 where the difference signal is amplified by IF amplifier transistor Q5, and coupled through tuned circuit L128 to the tuner output terminal.

UHF SECTION

The UHF signal is routed to the UHF tuner section by forward-biasing diodes CR1 and CR2. It is tuned by varactor diode CR3 and inductor L6 and amplified by RF amplifier transistor Q1. From the output of Q1, the signal is coupled through double-tuned varactor/inductor circuits CR4/L11 and CR5/L12 to mixer diode CR6. The signal is mixed with the signal from oscillator transistor stage Q2 to produce an intermediate frequency in the 45 MHz range. This signal is amplified by transistors Q4 and Q5 and cascoded whenever the tuner is on the UHF band.

Tuning voltages, low VHF, high VHF, superband, hyperband, and UHF band switching voltages are applied to the tuner from the tuner control module. IC1, a divide-by-64 integrated circuit, divides the oscillator signal for use by the phase-locked-loop (PLL). This signal appears at pin 5 as the "prescaler output."

IF AMPLIFIER

The tuner module incorporates an amplification stage for the 45 MHz IF. Common base amplifier transistor Q5 receives the input signal on its emitter through coupling capacitor C143. The output signal appears on its collector and is tuned by L128 and C148. The IF signal is then coupled to the video IF module through C158.

SYNC SEPARATOR, AGC, AND MASTER SCAN OSCILLATOR

The C2 output from pin 9 of the synchronous detector is applied to pin 1 of IC1351 through a low-pass RC network formed by R1354 and C1353 to filter out the 4.5 MHz sound. It is then applied to an AGC comparator. The AGC comparator samples the sync tip level, compares it to a 4-volt reference level set by CR1353 from the AGC gate circuit during the gating time, and then either charges, discharges, or does nothing to primary filter capacitor C1327 at pin 15. The gating time is determined by the time coincidence of the flyback pulse coupled to the IC at pin 16 and the sync pulses from the sync separator.

The DC level of primary filter capacitor C1327 is applied to the AGC amplifier. The purpose of the internal AGC amplifier is to limit the swing of the IF AGC voltage from the maximum IF gain to the delay or crossover point. This limit is determined by the bias at pin 14 of the AGC delay set by Delay control R1353 at pin 13. There is an external RC network between pins 13 and 14, which is called a feed-forward circuit. It allows additional gain reduction beyond the crossover point in the event of large, fast changes in signal strength. The IF AGC output is filtered before it is applied to the IF. This filter consists of R1327, R1329, and C1331. The 4.3 volt zener diode in series with the AGC delay control provides for a constant delay or crossover point, independent of B+ variations. This entire circuit, as well as others, reduces the need for module adjustment or alignment, should the module be replaced during service.

AGC output is provided for the tuners at pin 12 for signal strengths beyond the delay point.

The C2 video output is also applied to a video amplifier within IC1351 and the signal is applied to a sync separator. The normal dual time constant sync separator network is at pin 2, which includes resistors U1351G, U1351F, and U1351E along with capacitors C1355 and C1356, and diode CR1352.

In addition to receiving the sync pulses at pin 4, a phase detector within IC1351 also produces a sawtooth voltage. This is generated by using capacitors C1354 and C1352 to integrate the 50-volt positive flyback pulse. The phase detector output is filtered at pin 10, and the noise immunity of the master scan oscillator system is determined by the components at pin 10, mainly C1329, C1328, R1330 and R1328. These selected components provide excellent performance when video tapes are viewed that have excessive skewing errors. The values of these components, however, are not optimized for excellent noise performance. In a fringe or noisy reception area, you can improve the noise immunity by placing a jumper wire across R1330. Holes are provided near the center of the board for this purpose. Resistor R1330 is in the horizontal APC system. A dashed line in the schematic near pin 10 of IC1351 (labeled "Slow Horiz") shows the connection of the jumper.

Within IC1351, the output of the phase detector is applied to the 503.5 kHz master scan oscillator. It is called a master scan oscillator because it's output frequency is not at a vertical rate, nor at a horizontal rate, but at a rate that is 32 times the 15,734 Hz horizontal rate. This output is applied to countdown circuit IC2101 on the chroma/luminance module, which counts down the 32 times rate (503 kHz) to the horizontal rate, and an additional 262.5 times to the vertical rate. Three pins are used for this internal master scan oscillator (pins 6, 7, and 8), with the output for the vertical and horizontal countdown taken from pin 7.

You can adjust the frequency of the master scan oscillator by shorting pin 3 of IC1351 to ground. Then, while you observe the screen, adjust the core of the frequency adjustment coil L1376 for a zero beat (slowest roll of the picture) for the horizontal and vertical oscillators.

Returning to IC2101, the synchronous detector also provides a negative-going composite video signal at pin 10 (C1 video output). This signal is coupled through L1202, R1239, Q1227 and Q1226 to the chroma take-off network. In addition, CR1226 at the C1 output, R1227 at the collector of Q1226, and R1229 at the AFC output and AFC defeat leads from pin 14, are added for protection in the event of an arc.

Two AFC coils on pins 15 and 16 provide the 45.75 MHz zero crossing and the negative hook in the AFC response. AFC coil L1228 provides for zero crossing and coil L1226 provides for the negative hook. The 4.5 MHz trap coil, L1207, is tuned to minimize 920 kHz beat in the chroma circuits. Limiter coil L1229, across pins 1 and 2, is adjusted for best video/chroma difference phase and gain. It can be aligned slightly for optimum preshoot/overshoot peaking if the tuner is perfectly tuned. To tune oscillator coil L1203 (across pins 6 and 7) to the middle of the AFC response when the tuner is correctly tuned, the coil is adjusted for 5.2 volts at the AFC test point on pin 5 of IC1201. This test point is between R1201 and C1208. To defeat or turn the AGC off, the AFC defeat connector pin on the module is grounded. This connector is shown just above Q1251.

When the tuner is properly tuned or the AFC is defeated, the AFC voltage is 3.8 volts DC at pin 12. The entire video IF circuit is powered by 12 volts at connector 3M pin 6 of the sweep module.

TUNER CONTROL MODULE (TUNING SYSTEM)

Refer to the Tuner Control Module Schematic Diagram while you read the following section.

The tuning system is formed by five main circuits: keyboard, memory, character generator, microprocessor, and interface. These circuits are each described in the following paragraphs.

KEYBOARD

The microprocessor constantly scans the keyboard by applying negative pulses to eight output lines (KO P10 through KO P13 and KO P20 through KO P23). When you press a key on the keyboard or close one of the slide switches, the pulse returns to the microprocessor on one of the five input lines (KIN P0 through KIN P3 or KIN P30). Each of these input lines has a pull-up resistor that holds the input at a logic 1 when no key is being pressed. When a key is pressed, the microprocessor determines which key is closed and initiates the proper response.

Input line 50/60 Hz is the 60 Hz input for the real time clock. Pull- up resistors R6774 and R6791 hold this input line at a logic high during the absence of a positive signal on the base of Q6720.

During the positive half of the 60 Hz line voltage, the signal is applied to the base of Q6720, which conducts and essentially grounds the juntion of R6774 and R6791. Input line 50/60 Hz becomes a logic low for this half cycle. During the other half cycle, Q6720 is off and line 50/60 Hz becomes logic high. The circuits inside the microproessor use the logic-low-to-logic-high transition for the real time clock.

MEMORY

The memory of this TV set allows you to program and store your favorite channels through the keyboard, and then scan the channels in an up or down sequence using the up/down Channel buttons. In case of a power failure, this memory is not lost, so you do not have to reprogram the channels again.

Memory integrated circuit IC6826 is a special memory IC. It operates similar to a random access memory (RAM) in that data can be stored in or retrieved from memory. However, unlike a RAM which loses memory when power is removed, the data stored in this memory is not lost if power is removed. It can retain its memory for up to a year.

Addressing, mode of operation, and data are transmitted from microprocessor's output lines KO P10, through KO P13, to the memory's input lines DA0 through DA3. Memory output lines DO0 through DO3 supply data to microprocessor input lines KIN P0 through KIN P3.

To read data from memory, the microprocessor outputs a 4-bit address. Clear line CE goes to a logic 0 to enable the memory. As CE changes from logic 1 to logic 0, the address is latched into the memory's control circuitry, and the microprocessor outputs a second 4-bit address, which returns CE to a logic 1 and latches the address. A 4-bit code instruction on the output lines returns CE to logic 0, causing the memory IC instructions to be carried out. The data from the specific address appears on lines DO0 through DO3 for input to the microprocessor.

To write (or store) data into memory, the previous sequence is used, except that after CE is pulled low the second time, the four bits of data to be stored are supplied by the microprocessor output lines. When CE goes high, data enters the memory control circuits and the write cycle begins. After the write cycle, which takes 100 milliseconds, the microprocessor's output pulls CE low and stops the writing cycle. CE returns to a logic 1 and the memory is released. Volume control setting information is also stored in the same manner.

To insure against accidental writing into memory upon power up, the PCLR line is pulled to +5 volts through R6853, and CE is pulled up through CR6827. In order to write into memory, the PCLR line must be at logic 0. As the +5 volt line rises, capacitor C6851 begins to charge through resistor R6852. Shortly after the +5 volt line reaches the normal level, C6851 becomes charged enough to turn on CR6851 and Q6860, and the PCLR line becomes logic 0. CR6827 is reverse-biased to isolate it from the CE line.

CHARACTER GENERATOR

The on-screen display is formed by rows and columns of characters. The channel/time display characters are two rows hgh and five columns wide. The microprocessor supplies information on output lines KO P10 through KO P13, and KO P20 through KO P23, to character generator input lines DA0 through DA6 and ADM. When LDI input is logic low, the microprocessor outputs a 7-bit word. This word is either an address that corresponds to a row and column for a given character, or an instruction for the display format, the enable display, or the disable display. As LDI changes to logic high, the 7-bit word latches into the character generator control circuits.

A second word is placed on the output lines which specifies a character on the data line required to carry out an instruction. At this time, LDI goes back to logic low, causing the information latched in the character generator control circuits to either store it at the indicated memory location, or to execute the instruction.

The ADM input on the character generator IC is used for address mode control. This input is a logic low during the time of the above operation. If ADM is a logic high, the previously latched address in the control circuitry increments by one. Only data for this new memory location is supplied by the microprocessor and is latched by a positive transition of LDI.

An RC network at OSC1 and OSC2 allows you to adjust the internal 4 MHz clock. The character generator utilizes a composite sync pulse input fed directly to an input on the microprocessor. The microprocessor breaks the pulse into the required horizontal and vertical outputs. Horizontal information is derived from a counter which places the display box image on the picture tubes.

Outputs VOW and VOB provide the on-screen display. A logic low output at VOB provides a black background, while a logic high output at VOW provides yellow characters. Buffer and driver transistors produce the proper amplitude and polarity. The drivers also interface to the main module to override the video so the appropriate information is displayed on the screen.

MICROPROCESSOR AND INTERFACE

Crystal CR6760, between the two OSC pins, sets the frequency of the internal 7.16 MHz clock required to operate the microprocessor. It is also the reference frequency for the phase-lock-loop (PLL) circuits contained in the microprocessor.

The serial bit stream that is generated in the infrared preamplifier circuits is applied to input IA IN where it is decoded by the microprocessor. The VOL OUT output provides DC voltage in 64 steps through volume driver transistor Q6776 to adjust the output level of the audio IC.

When a channel is selected, the microprocessor checks the state of the CATV/Normal switch and then obtains the required divide ratio for its ROM. This causes the internal dividers to produce the required reference frequency for the PLL along with two bits of bandswitch information. The bandswitch logic is latched at outputs Logic A and Logic B of the microprocessor IC, and at B/S and SB/S of the interface IC. This causes the tuner control to select the proper band. Minimum tuning (clamp) voltage is also set for each band to prevent the oscillator in the tuner from stopping due to low tuning voltage.

A prescaler in the tuner divides the tuner oscillator frequencies by 64 before they are applied to the LFI input of the microprocessor. The microprocessor further divides this frequency and then applies it to the PLL circuits. The PLL adjusts the duty cycle of a 2 kHz, 5 volt peak-to-peak output at PD0. This signal is applied through resistor R6788 to OP IN on the interface IC. An operational amplifier connected between OP IN and OP OUT is supplied by a 32-volt, 13.6 milliampere constant current supply at ISS. R6678 and C6678 provides feedback from the output to the input for filtering. The filtered DC tuning voltage at OP OUT is applied to the VHF/UHF tuner and adjusted to obtain and maintain phase-lock between the oscillator and microprocessor-supplied reference frequency.

In the normal mode, the tuning system always places the tuner oscillator at the correct frequency to receive an FCC-specified channel frequency. At some CATV or MATV installations, the channel oscillator frequencies are offset from the FCC-designated standard. This is done purposely to lessen interference. Some inexpensive TV games also operate on offset frequencies. Provision is made to capture channels that are offset by as much as 3.25 MHz whenever the AFC switch is in the Special position.

Pull-down resistor R6766 holds the AFC IN input to the microprocessor at logic low when a logic high is not present at the anode of diodes CR6741 or CR6742. AFC voltage (see Pictorial 9-1) from the IF module is applied to the interface IC at AFC IN. Internally, this voltage is applied to three comparators. The outputs from two of these comparators are connected to the AFC WIND output and produce a logic high if the voltage is in the window (+1 volt to +5 volts). The output of the third comparator is applied to AFC CENT and produces a logic high or logic low, depending on which side of the center voltage (+3 V) the AFC happens to be. When a channel is selected in the special AFC mode, the system first synthesizes the correct frequency for that channel.

The microprocessor places a logic low on the KO P21 output, which causes the anode of diode CR6742 to become clamped to logic low through R6742. This happens regardless of the AFC window level. The microprocessor now checks input AFC IN. A logic high from the AFC CENT output of the interface IC, applied through CR6741, indicates the need for tuning down. A logic low indicates the need for tuning up. The microprocessor steps the tuning voltage in small increments which, in turn, change the tuner oscillator frequency. If the tuning voltage is being stepped down, the microprocessor looks for a high-to-low transition of the AFC CENT output at AFC IN, or looks for a low-to- high transition if it is stepping up. This transition indicates that the center frequency has been found and the stepping ceases. At this time, the processor checks for the validity of the carrier. For a carrier to be valid, the output of the AFC window must be present at microprocessor input V SYNC. Vertical sync from the sync integrator on the IF module is applied to input IV on the interface IC. Here, it passes through a comparator to the V Sync output. If the carrier is invalid, stepping resumes.

After each tuning voltage step, if the center frequency is not found, output KO P21 goes to a logic high and KO P20 goes to a logic low. This applies the AFC window signal to input AFC IN, which disables AFC CENT. If AFC WIND goes to a logic low, the microprocessor determines that the edge of the

AFC window is reached and begins stepping in the opposite direction. If the microprocessor does not find a valid carrier, stepping continues to the other end of the window, where the AFC WIND output again becomes a logic low and stops the stepping action. During the time the system is looking for a valid carrier, the raster is blanked and the sound is muted. When a valid carrier is located, or if the system searches the entire window without finding one, blanking and mute are disabled.

When the Stereo, 2nd Audio, or Mono key is pressed, the negative pulse from microprocessor KO P23 is returned to KIN P10. The microprocessor then tells the stereo decoder that stereo has been selected and turns it on. If the stereo decoder detects the presence of the pilot signal, a logic 0 is entered on the base of Q6760 to forward-bias CR6739 and activate the microprocessor at SW IN P31. The microprocessor places a logic 0 at Q6780 and turns on the stereo LED indicator. If no stereo pilot signal is detected, the microprocessor turns the stereo LED off via Q6780 and Q6781.

If the 2nd audio, or language, is detected, the microprocessor is informed in the same manner as the stereo pilot to activate Q6761 and forward-bias CR6740 and the microprocessor. The stereo decoder is thus informed and the second language function is activated.

VIDEO IF MODULE

Refer to the Video IF Module Schematic Diagram while you read the following section.

The video IF signal passes through the SWIF IC1202 (Surface Wave Integrated Filter) and then enters the IF gain circuit via pins 1 and 14 on IC1202. The IF signal is amplified by IC1202, which has its gain controlled by an AGC voltage applied at pin 5.

The output circuit of IC1202 consists of maximum gain coil L1205, which is across pins 7 and 8 and a capacitive tap network to match and drive the synchronous detector IC1201. This is a narrow bandwidth, high Q-circuit that is tuned to the IF picture carrier for maximum contrast with weak signals.

With strong signals, pin 6 of IC1202 applies a high DC voltage to the base of the de-Q-ing transistor Q1201. Under this condition, the transistor conducts and represents a direct load across the IF gain output tuned-circuit. This additional load lowers the Q and widens the bandwidth of the circuit. Part of this load is a tuned 41.25 MHz sound trap in the transistor emitter circuit to reduce the sound carrier level. The result is a 920 kHz beat in synchronous detector IC1201. The design of the sound trap keeps the sound carrier level constant throughout the AGC/signal level range of the receiver. The constant sound carrier level reduces audio noise degradation at weak signal levels.

The signal is then processed by synchronous detector IC1201 and the composite video signal (approximately 3 volts peak-to-peak with negative-going sync pulses) appears at pins 9 and 10. At pin 9, the composite video signal is coupled through R1354 to pin 1 of IC1351 for sync processing.

STEREO IF MODULE

Refer to the Stereo IF Module Schematic Diagram while you read the following section.

The stereo IF module is designed to accept either the 45 MHz sound IF signal from the tuner output, or a 4.5 MHz sound IF signal fromthe IF amplifier.

The 45 MHz IF signal is input at J1201 and J1202 and applied to the base of emitter-follower transistor Q1201, and then to the SWIF IC1201, which traps out chroma and reduces audio buzz. The output of U1201 is applied to pins 7 and 8 of IC1201 where it is detected and processed in a manner similar to a normal video IF. L1230 and C1240 form a 4.5 MHz oscillator. L1209 and its internal circuitry form a limiter circuit whose output is applied to a phase detector at R1213 and C1242. L1204 is a bandpass coil to set the picture carrier at the proper place in the response curve. The detected 4.5 MHz signal now appears at pin 17 and is passed on to 4.5 MHz quadrature detector IC1400 through U1202. U1202 is a ceramic bandpass filter which has a wide enough response to accommodate the 73 kHz FM MTS signal.

IC1400 employs a double-tuned detector coil L1402 for better linearity in demodulating the 4.5 MHz signal. The output audio signal is applied to the base of Q1401 and exits at connector 1D4 to the stereo decoder module.

STEREO DECODER MODULE

Refer to the Stereo Decoder Schematic Diagram while you read the following section.

The composite audio input signal consists of the stereo and SAP (second audio program) and is applied to the base of emitter-follower transistor Q1625. Signals which appear at the emitter of Q1625 are coupled to IC1601 through R1601 and C1602. U1601 is the same type of stereo decoder used in standard FM receivers with some slight modifications. The output from pins 4 and 5 of IC1601 contain L+R and L−R signals. The output at pin 7 drives a stereo LED indicator when the stereo pilot signal is detected. A1604 is a 78.67 kHz trap which attenuates the second audio and reduces crosstalk between the stereo and second audio.

R1611 adjusts the free-running frequency of the phase-locked-loop (PLL) contained in IC1601. IC1601 also contains a stereo switch and a decoder which provides L+R and L-R at its output. The L+R and L−R signals are passed through low-pass filters A1602 and A1603. The L+R signal is routed through matrix decoder R1619, R1620, R1603, R1607 and amplified by IC1609. The L−R signal is passed on to the DBX decoder. R1618 is a L−R level adjustment to correct for gain differences in stereo decoder IC1601. The L−R signal then passes through Q1617 and Q1618, which are electronic switches, and allow either second audio programs or the L-R audio to go to the DBX decoder, IC1607. R1703 adjusts the timing of the DBX circuit and R1709 is a high band trim adjustment.

The purpose of the DBX decoder is to restore the audio to its original characteristics. In transmitting, the audio is compressed or encoded, and then expanded or decoded at the receiver. This process is accomplished to enhance the signal-to-noise performance. From the DBX decoder at pin 15, the signal is passed on to dual-amplifier IC1608 at pin 2 via R1720 and R1769. The signal is amplified by half of IC1608 and then returned to the DBX decoder through C1707 and R1704. The L−R signal exits at pin 8 through C1618 to the second half of IC1608 at pin 5, where it is amplified and exits at pin 7. The amplified signal is applied to matrix amplifier IC1609 together with the L+R audio signal from C1610 and R1603. In the matrix amplifier and its associated circuits, the L+R and L−R signals are added and subtracted to give the L and R audio signals. R1626 and R1627 are the left and right matrix controls.

The left and right audio channels then go to 4-channel stereo switch IC1603 at pins 13 and 11. The external audio channels are also applied to pins 15 and 17 of the stereo switch. When the SAP signal is selected, it is switched via Q1618 and eventually applied to IC 1603 at pins 11 and 13 instead of the left and right audio channels. Audio inputs to IC1603 are controlled either by DC voltages applied to connector 4B6, or electronically via Q1616 or Q1618.

2ND AUDIO

The SAP at the emitter of Q1625 is applied to 78 kHz bandpass filter A1601. After filtering the signal, it is amplified by Q1606 and Q1608 and routed to the carrier detector at CR1601 and CR1602. It is rectified and applied to Q1605 to drive SAP mute transistor Q1604 and the SAP presence indicator at pin 3 of connector 4Q6. SAP decoder IC IC1602 is a phase-locked-loop IC. R1652 and R1653 control the frequency of its internal oscillator. The 78 kHz FM signal is fed to pin 2 of the decoder. The demodulated output signal at pin 7 is filtered and amplified by Q1607 and Q1616 and the output level is set by R1671. The signal passes on to a dual emitter-follower DBX input switch at Q1617 and Q1618 which controls the DBX input, or L-R signal. When the SAP signal is applied to the 4-channel stereo switch, the stereo inputs are shorted together internally.

STEREO AUDIO PROCESSING

The fixed level output of IC1603 is passed to connector 4B4 via R1749, C1679, R1750, and C1680. These same stereo audio channels are also fed to the audio processor, IC1604, where the Bass, Treble, Volume, Balance, and stereo enhancement are all controlled by DC voltages applied via connectors 4D6, 4A6, and 4B7. Transistors Q1610, Q1611, and Q1612 are used to match the DC volume controls of different Zenith systems to this processor. An improved stereo effect is accomplished by using a small amount of phase-reversed internal cross-coupling. This feature is activated by the Extend Stereo switch on the control panel via connector 4D6. Finally, the variable stereo audio is output at connector 4G3 to drive the stereo power amplifier.

STEREO AMPLIFIER MODULE

Refer to the Stereo Amplifier Module Schematic Diagram while you read the following section.

Left and right audio channels from connector 8F4 are applied to IC101 and IC201 through C101, C102, R29 and R31. The audio signal is amplified in each circuit and exits at connectors 8B4 and 8J4. Connector 8P supplies the 36 volts B+, which is filtered by capacitor C110, for the stereo amplifier module.

STEREO INTERFACE MODULE

The stereo interface module inputs 25 volts from connector 803 pin 3 through R10 to regulator IC1. The 12 VDC output of the regulator powers the stereo processing circuitry.

AUDIO/VIDEO ISOLATION MODULE

Refer to the Audio/Video Isolation Module Schematic Diagram while you read the following section.

The video from an external source is applied to pin 4 of connector 2A and coupled through C310 to emitter-follower Q301, where it is impedance-matched to the pin 12 input of U301. U301 is a 45 MHz modulator for sound and video. The sound portion of the signal is not applicable to this set, so only the video section will be discussed.

L301 and L303 form a tank circuit which sets the frequency of the modulator. After the signal is modulated to an IF frequency, it is fed to J2 through CX305 and CX354. A positive 20 volts is applied from 438 pin 3 through F401 and CR402 to series regulator transistor Q402 to supply +13 volts to the module circuitry.

CHROMA/LUMINANCE MODULE

CHROMA CIRCUIT

Refer to the Chroma/luminance Schematic Diagram and Pictorial 9-2 in the Illustration Booklet while you read the following sections.

The chroma signal is applied to the overdrive limit amplifier input at pin 10 of IC2351 to limit signals of 1 V P-P or larger to aid in speeding the chroma APC pull in. The limiter also provides a DC signal to the ACC pickup noise canceller and the AC chroma signal to the ACC amplifier.

The ACC amplifier is a DC gain-controlled amplifier which, in addition to the chroma signal, receives an AC signal for pickup noise-cancelling, and the DC gain control signal from the ACC phase detector via the offset control stage. The amplifier provides two signal outputs, the AC gain-controlled chroma signal and the DC signal to the color killer.

The chroma signal is capacitively-coupled through C2358 from pin 12 to pin 14. The signal is fed from pin 14 to an overload limiter that prevents very high level signals from saturating the ACC and APC phase detectors.

From the limiter, the signal splits and goes to the ACL (automatic color level) limiter and the APC and ACC phase detectors. From the ACL limiter, the signal goes to the burst blanker. The blanker is driven by the burst/clamp gate, which deletes the burst from the signal to allow the auto tint circuitry to operate. The chroma, without the burst, is then fed to the color level amplifier, along with a DC signal from pin 13 (color level control) and a DC signal from the color killer.

The color level amplifier gain is controlled by the pin 13 voltage. The color level amplifier output feeds the chroma picture control amplifier, which is controlled by the picture control in the luminance circuit. The output at pin 16 drives a single-tuned L2327 chroma bandpass filter which, in turn, drives the demodulators at pin 18 of IC2351.

The color killer circuit in the IC has no external filter. It receives a DC signal from the ACC amplifier that is similar to ACC gain. When the gain is sufficiently high, indicating a low or nonexistent chroma burst, the color killer cuts off the DC current supply to the color level amplifier. The APC and ACC phase detectors are double balanced with push-pull out-

puts. Both detectors receive the chroma signal from pin 14 after the overload limiter. The reference signals are received from the voltage-controlled oscillator (VCO).

The ACC detector receives a signal at the B-Y phase, and the APC detector receives a signal at the R-Y phase. Therefore, the ACC detector is an amplitude detector and the APC detector is a quadrature phase detector. The ACC detector output is fed through a switchable 2- level offset to the ACC amplifier. Switching the offset changes the reference output level of the ACC amplifier, thus allowing a switchable ACL function. The offset is switched by the auto switch at pin 17. The APC detector drives the VCO phase shift matrix whose output is a DC voltage proportional to the phase angle between the VCO phase detector input and phase detector burst input. The external feedback path contains an output integrator, R2326 and C2326, a 3.58 MHz crystal, CR2326, and an input integrator, R2351 and C2351.

The required matrixing for the tint control circuit is all performed internally at IC2351. The signal at pins 26 and 28 is fed to the tint phase shifter where the signals are DC controlled by the voltage at pin 25. The outputs of the phase shifter are four quadrature currents whose phase relative to the burst can be changed by "±"45°. These currents are then matrixed to provide the reference phases for the demodulators at 100° apart. The output of the tint matrix is direct coupled to the demodulators.

Two double-balanced demodulators with a G-Y matrix are used in the IC. Chroma is applied at pin 18 and the subcarrier is applied internally from the tint matrix. G-Y is derived by matrixing the appropriate currents from B-Y and R-Y. The outputs at pins 19, 20, and 21 are positive blue, green, and red respectively.

The auto-color system performs three functions: to control the ACL circuitry, the auto-tint circuitry, and the color killer threshold. It controls the ACL by changing the offset at the output of the ACC detector. This changes the burst level and correspondingly changes the chroma level to limit over-saturated colors in the auto mode and change the color killer threshold. This allows the viewer to use the Auto switch to set the level of color kill.

The auto tint matrix combines portions of B-Y and R-Y to give an "activation" area from about 30°. The matrix is fed to the auto tint comparator and an attenuator. The attenuator establishes a voltage which is proportional to the operating voltages of the R-Y and B-Y demodulators. The sample-and-hold establishes a voltage on capacitor C2359 at pin 17, which is the reference voltage for the comparator. The other voltage on the comparator is higher during the burst interval because it is not attenuated. This offset disables the enable circuit. If there is nothing in the 30° to 210° semicircle being demodulated during the scan, the comparator is disabled and the system does not correct.

However, if a color is present in the semicircle, the comparator enables the system and the voltage follower and current source are activated. The voltage follower reduces the gain of the B-Y demodulator and makes the R-Y axis preferable. Colors that are away from the R-Y signal are shown in Pictorial 9-2. The current source draws current from the B-Y output operating point and causes the R-Y corrected signal as shown in Pictorial 9-3.

LUMINANCE CIRCUIT

The input to the luminance circuitry at pin 2 of IC2351 is driven by a 1.5 V P-P video signal from delay line L2276. The input signal is internally buffered and drives a series RLC network to derive the peaking and low-pass luminance signal.

RLC inductor L2251 is connected across pins 4 and 6 of IC2351 to produce a second signal called the "f" signal. This "f" signal is a bidirectional pulse used as the preshoot/overshoot peaking signal. The low-pass luminance "f" signal appears across C2252 at pin 6. The internal IC circuitry can process the common luminance and differential mode peaking signals separately. This adds a variable amount of the peaking signal back to the luminance to control the picture sharpness.

The process of adding the peaking signal to the luminance signal is accomplished inside IC2351. Under minimum peaking conditions, pin 1 is at 12 volts and all the internal signal processing transistors conduct equally. In this state, the positive and negative peaking signal is present in the luminance signal

at the video output. As the voltage at pin 1 is decreased, the additive process is decreased, while the amount of peaking signal present in the luminance at the video output increases.

The automatic brightness limiter circuitry is also internal to IC2351 and controls the gain of the video circuitry. With no current flowing through the tertiary winding of the high voltage transformer into the CRT anode, the voltage at pin 3 of the IC is normally 3.66 volts. This voltage is determined by a resistive/divider network. As current starts to flow into the anode of the CRT, the current is drawn from the junction of IC2151D and IC2151E. When the anode current reaches 1.5 mA, the voltage at pin 3 of the IC in normally 3 volts, which activates the internal picture control circuitry. This results in a reduction of the video gain and anode current.

VIDEO OUTPUT MODULE

Refer to the Chroma/luminance Module, the Focus Control Module, and the Video Output Module Schematic Diagrams while you read the following section.

The video output stages relate to Q2701, Q2702, and Q2705 and their associated circuitry on the chroma/luminance module and Q5226 on each of the three video output modules. The amplifier system is a common emitter circuit whose transistors drive the CRT cathodes through Q5226 on each of the three modules. Adequate frequency response is obtained by peaking components C2701, C2702, C2703, L2701, L2702, and L2703 on the chroma/luminance module, and L5226 on each video output module.

The inductors are self-resonant at the second harmonic of the chroma signal and trap out 7.2 MHz, or the second harmonic of the chroma signal, and prevent its appearance in the picture. In addition, these inductors provide some video peaking in the 2 to 3 MHz range. The CRT cathode current flows through each video output module transistor Q5226. It then passes through chroma/luminance module transistors Q2701, Q2702, and Q2705, inductors L2701, L2702, and L2703, and the associated resistors, to pins 19, 20, and 21 of IC2351. On the positive transitions of the video signals, diode CR5201 between the base and emitter of Q5201 is turned on and conducts the video to the cathode. In this manner, IC2351 can determine the value of the cathode current without interfering with the passage of video through the transistor to the cathode. Resistor R5201 and the spark gap help suppress arcs that could damage Q5201.

CRT VOLTAGE GENERATION

The fixed DC voltage for the control grid of each CRT is developed in a special circuit that couples this voltage to pin 3 of connector 5B. This circuit has two functions; one is to develop the G1 bias voltage, and the other is for spot-burn protection. The 250-volt source is divided by resistors R5313 and R5316, while C5303 filters the voltage at pin 3 of connector 5B. The other components of the G1 voltage generator circuit form spot-burn protection. C5301 and R5314 form a time constant of several seconds to maintain G1 voltage after the receiver is turned off.

SWEEP MODULE

Refer to the Sweep,Video IF, Tuner Control, Raster Registration, and Chroma/Luminance Modules Schematic Diagrams while you read the following section.

HORIZONTAL DRIVE AND OUTPUT

When 12 volts is supplied to vertical IC1201 on the chroma/luminance module, an internal oscillator and count-down circuit provide a horizontal drive output at connector 2F pin 4. Prior to power up, a 132- volt standby is supplied by the switch mode power supply to the collectors of Q3301 and QX3326. When the horizontal drive signal is applied to Q3328, it is amplified and drives horizontal predriver transistor Q3301. The output is then transformer-coupled to the base of the horizontal output transistor QX3326. At this time, the horizontal output transformer begins to function and supplies voltage to the various circuits. Diode CRX3301 acts as a damper diode. In addition, a shut-down circuit protects the viewer from harmful X-ray radiation by sensing the high voltage. If the limits are exceeded, it turns on latch transistors QX3376 and Q3327, to clamp the horizontal drive signal and disable the horizontal output by turning on QX3329.

Another shut-down circuit is used as a horizontal yoke open/short protection. Transformer TX3351 primary windings are balanced with equal but opposite currents in each half so zero output voltage is produced on the secondary windings during normal operation. If any one of the horizontal windings, or one of the yoke windings should open or short during operation, an unbalanced condition is produced in the transformer. This causes a substantial voltage to appear at the secondary, which is rectified by CR3351 and filtered by C3353. The voltage triggers the latch circuit and clamps the horizontal drive pulse via switch transistor QX3329. The latch circuit also enables a raster blanking circuit via connector 3C2 at pin 2.

VERTICAL SWEEP SHUTDOWN

The vertical circuit also has a protection system for short or opens, just like the horizontal circuit. Transformer T8501 on the raster registration module has three primaries, one for each vertical yoke winding. During normal operation, no secondary voltage is available because current in all three primaries is equal. Should one of the yokes open or short, the secondary voltage rises. This voltage is rectified by CR8563, filtered by C8572, and coupled back to the chroma/luminance module via connector 2G8 pin 2. Raster blanker transistor Q2226 cuts off drive for all three CRTs and also reduces CRT burn possibilities.

OVERBEAM SHUTDOWN

Beam shut-down transistor Q2651 senses the ABL level for excessive beam current. During excessive current, beam current shut-down transistor Q2676 turns off. The crow bar circuit turns on and loads the 5 V supply to IC6700 at pin 6 to drop the supply to 3.5 volts or less. The microprocessor resets to the off state, and turns the receiver off to prevent CRT burn.

VERTICAL OUTPUT CIRCUIT

A 503 kHz frequency is created on the video IF module by sync scan processor IC1351 and applied to vertical IC1201 at pin 9 along with composite sync. These two signals are processed within the IC to provide 60 Hz drive for the vertical output circuit and 15,734 kHz for the horizontal drive.

Some pulse control or shaping is achieved by L2126, C2101, R2176, and CR2127. A sawtooth output voltage is produced at C2102 by changing and discharging it through constant current supplies. The discharge current is varied by Vertical Size control R2126. This changes the peak-to-peak switch of the wave since it always charges to the same level.

The voltage ramp from the ramp generator is DC coupled inside IC2101 to one side of a differential amplifier. The differential amplifier output at IC2101 pin 6 drives a transistor vertical output stage. The vertical output section consists of transistors Q2151 and Q2101 and their associated circuitry. During the top half of the trace, Q2101 acts as a driver for Q2151 and the IC feeds just enough current into the base of Q2101 to make the yoke current look like the voltage ramp.

The yoke current path is from the 62-volt supply, through Q2151 and RX2152 in the emitter, through connector 2G8 to vertical high, to 8H on the raster registration module, through the yokes, back to connector 2G8 at vertical low, and into the feedback network. From there, it passes through capacitor C2154 and parallel resistors RX2177, RX2154, and U2151D and E to ground. During the bottom half of the trace, Q2151 is off and the yoke current passes from ground through the same resistors and capacitor as before. It also passes through RX2153, CR2152, and Q2101. C2151 is a bootstrap capacitor which decreases vertical retrace time by about 20%.

The yoke current passing through parallel resistors RX2177 and RX2154 results in a voltage across these resistors that is proportional to the yoke current. This voltage is shaped by the feedback network to correct vertical linearity. This waveform is then coupled back to pin 5 of IC2101.

An integrator clamp and bias network at pin 12 of IC2101 is comprised of C2128, C2153, C2156, U2151A, U2151B, and R2131. Composite sync is integrated and AC coupled to pin 12 of the IC. R2131 and R2101 provide a high impedance bias voltage below the trigger level at pin 12. This assures triggering on weak amplitude pulses but not on noise. C2106 at pin 10 of the IC and R2107 are timing components for the IC.

FOCUS CONTROL ASSEMBLY & MODULE

Refer to the Focus Control and Sweep Modules Schematic Diagrams while you read the following section.

FOCUS AND SCREEN CONTROL SET UP

The focus assembly provides for the proper distribution of CRT focus and other bias voltages. The current path is from the high voltage secondary winding of TX3302 on the sweep module to pin 3 of connector 3B5, to R5310, through R5307, R5304, R5301 and their resistive divider networks. It is then applied to the focus resistor networks via connector 5R, and finally back to the voltage quadrupler, TX3302. R5307, R5304, and R5301 are screen controls; one for each color CRT. They are used to set up for proper background color balance. When the Normal/Setup switch on the focus module is in the Set Up position, video bias is disconnected from the tubes and a fixed bias voltage is applied.

RASTER REGISTRATION MODULE

Refer to the Raster Registration Module Schematic Diagram while you read the following sections.

VERTICAL CIRCUIT

Vertical height of the three images is accomplished by resistive loading of the vertical yoke section. R6554 is a fixed load across the green yoke section. The Raster Height control on the chorma/luminance module is adjusted to set the correct height for the green gun. Variable controls for the red gun and blue gun heights are adjusted to match the green.

Centering is accomplished by means of three resistive bridge configurations along with plus or minus DC centering currents flowing through each yoke winding. Linearity adjustment, critical in a projection system of this type, is accomplished by each vertical linearity control connected across the yoke winding. The circuit across the yoke is effective only on one half of the vertical scan, depending on which way the steering diode is connected by means of the dual jumper socket.

HORIZONTAL CIRCUIT

Horizontal centering, width, and linearity are handled in a conventional manner. All three horizontal yoke sections are driven in parallel with an interlock provision in the event that any horizontal yoke section is disconnected. Anode voltage will not be applied unless the yokes are connected. Each horizontal centering control has a negative and positive potential across it, which determines current flow in the horizontal circuit. The width coils are adjustable and change inductance on the horizontal yokes, causing them to draw more or less drive current. The linearity is similar.

POWER SUPPLY

Refer to the Switch Mode Power Supply Module Schematic Diagram while you read the following section.

In a switch mode power supply, it is important to note that several losses occur in the transformer due to turns ratio leakage, inductances between primary and secondary windings, frequency conduction time, etc. Once the transformer has been specified for leakage and turns ratio, the frequency and duty cycle then determine the output voltage.

If the line voltage raises, or if the secondary load decreases, the output voltage will try to rise. In order to keep these constant, the duty cycle decreases and the frequency increases. If the line voltage falls or if the load increases, the output voltage will try to fall. At this time the duty cycle increases and frequency decreases. The range of frequency generally varies from about 16 kHz to 76 kHz, and the duty cycle from 1:2 to 1:20. The extreme conditions are found from 108 volts with high beam and full audio, to 132 volts with the set off.

As long as the TV line cord is connected to an AC outlet, the power supply will run. It supplies 132 volts for sweep and 12 volts DC stand-by voltage for space command. When the set is turned on, an on/off pulse from the tuner control module is applied to the base of Q3402, turning it on, which in turn activates Q3403 and Q3404. At this time the 12 volts switched and 35 volts will turn on. The switched 12 volts will begin to supply power to the horizontal drive, which begins the sweep and high voltage.

When power is applied to the set, an AC voltage is rectified and filtered to provide 150 VDC to the system. This voltage is applied to one winding of transformer TX3401 and the collector of switching transistor Q3401. Base drive current is supplied by IC3401 to turn Q3401 on and off.

When the transistor turns on, the primary of TX3401 is grounded through transistor Q3401. The current and voltage are induced into the secondary windings where the various voltages are rectified by CR3410, CR3411, and CR3412 to supply 132 VDC, 12 VDC, and 35 VDC, to the various circuits.

During start up, the line voltage is rectified by CR3405, coupled through R3409, filtered by C3407, and applied to pin 9 of IC3401. The voltage on pin 9 is approximately 7.5 VDC and causes the IC to supply base drive to Q3401 to start the operation A flyback pulse is induced to a second winding, rectified by CR3406, and filtered by C3407. The voltage at pin 9 will now be 12 volts, and since this is greater than the supplied 7.5 VDC by CR3405, the circuit changes in frequency and duty cycle are controlled by the regulation windings of the transformer at pins 4, 5, 6, and pins 2, 3, and 4 of IC3401. The IC provides a voltage at pin 1 of about 4 volts. The transformer voltage is rectified by CR3409 to approximately −23 volts. The current flowing from the 4-volt supply at pin 1 of IC3401 through R3410, R3409, R3405, and R3406 to the −23 volts provide a voltage drop across R3410 and R3409 of about 2 volts. This 2 volts reference is fed into pin 3 of IC3401 and determines the frequency and duty cycle of the base drive of Q3401.

A change in line voltage or in the load will be sensed by the feedback winding and transformed to a voltage change at CR3409. A change of only a few millivolts at pin 3 of IC3401 will be sensed and the duty cycle and frequency changed accordingly.

Pin 2 of the IC is a zero crossing detector. The voltage from pin 4 of transformer TX3401 is fed to the IC through R3407 and R3408. It will be an approximate square wave ranging from −.02 to .7 V. When the voltage at pin 2 rises to 0 volts, the IC senses the increased load and turns on the base drive. This turns on the transistor and starts supplying energy to the transformer core once again.

Turning off of the transistor is controlled by pin 4 of the IC. This pin is connected through a capacitor to ground and through a resistor to the 150-volt supply. Pin 4 of the IC starts with 2 volts charging C3410 through R3401 when the zero crossing at pin 2 turns on Q3411. The voltage at pin 4 slowly ramps up toward a limit of 4 volts. At some point below 4 volts, the voltage at pin 4 has reached the reference point of an internal comparator, which shuts down Q3401.

REMOTE CONTROL TRANSMITTER

Refer to the Remote Control Transmitter Schematic while you read the following section.

Initially, the x-ports (IC1 pins 1-5 and 16-18) are set to a logic high output and the Y ports (pins 7-10) are set to sense the input state. When a transmitter button is pressed, a connection is made between the X and Y ports. The Y port senses the closure and the oscillator is turned on, running for 37 milliseconds to allow for any debounce. The Y port senses the column in which the button is located and the information is stored in the X-Y decoder of IC1.

The X-ports are switched to the input state and the Y-ports are placed in the output state at a logic high level so that they can be sensed at the X-port. The row of the depressed button is located and sensed at the X-port and stored in the X-Y decoder, and the button scan sequence is complete. At this point, the X-Y discriminator determines which button has been depressed and causes the appropriated command information to be transmitted to the TV set.

A new, type "J" style, 6-volt battery is used to power the transmitter.

CROSSHATCH GENERATOR

Refer to the Crosshatch Schematic while you read the following section.

The crosshatch generator provides a crosshatch pattern for use during adjustments.

The vertical high signal from the vertical high point on the chroma/luminance module is connected to point C and is shaped and amplified by transistor Q901 and IC U901D to provide square-wave pulses during vertical retrace. Horizontal retrace pulses from R2206 on the chroma/luminance module are at point E and are shaped and amplified by transistor Q904 and IC U901A to provide square-wave pulses during horizontal retrace.

Horizontal lines on the screen are generated by dual up-counter IC U902. Vertical pulses at pins 7 and 15 reset the counters. After reset, horizontal pulses applied to pin 1 are counted. Every twentieth horizontal pulse causes pins 6 and 14 to become a high logic for one horizontal line time. Diode D901 and transistor Q905 are turned on, and apply the positive pulse to the Comb/LUMA pin on the color/luminance module. This turns on the video output transistors and produces a white horizontal line on the screen. Since two vertical fields make up one vertical frame, a line is produced in each field and appears as a double line.

The vertical lines on the screen are generated by U903, an edge-triggered multivibrator, which is connected as a resettable, astable multivibrator. Transistors Q902 and Q903 invert the vertical and horizontal pulses, respectively, which are then applied to U903 pins 3 and 13 to reset the multivibrator. Reset is also applied through resistor R918 to U901B pin 5. This reset operation causes the output of U903 pins 7 and 9 to be logic high. A very short time after, the reset is removed. The time is determined by resistor R918 and the input capacitance of U901. Pin 5 of U901 becomes logic high and produces a

logic low at U901 pin 4 and at the negative trigger input (pin 11) of one-half of U903. Pin 9 of U903 becomes logic low for approximately .4 microseconds (as determined by R917 and C903). The logic low at pin 9 causes diode D902 to conduct, which produces a white vertical line on the screen in the same manner that the horizontal lines were produced.

When pin 9 returns to logic high, the rising edge of the waveform triggers the positive trigger input to the other half of the multivibrator. This causes U903 pin 7 to become logic low for approximately 4 microseconds (as determined by R916 and C902). At the end of this period, when pin 7 goes back to logic high, U903 is again triggered at pin 11 and the process repeats. The vertical pulse applied to pins 3 and 13 of U903 prevents the multivibrator from operating during vertical retrace.

26 VDC is applied to point F on the Crosshatch board from R10 on the stereo interface module.

With the Normal/Crosshatch switch in Normal, 26 volts DC is an open circuit. In the Crosshatch position, the 26 volts DC from point F is supplied through R921 to D905, which produces 16 volts DC for crosshatch operation.

SPECIFICATIONS

Rear Screen	Fixed, vertical black striped lenticular in combination with an off-centered fresnel.
Screen Gain	Nominal 5.
Viewing Angle	Horizontal 70 degrees, vertical 12.6 degrees.
Screen Size	45-inch diagonal with 4 × 3 aspect ratio.
Optics	Three USPL*, compact delta 7, 3-element coated acrylic lenses.
Limiting Resolution	Minimum of 3 line pairs/mm across a 5″ image diagonal.
Projection Tubes	Three 6 V″ high dynamic drive, short neck, liquid cooled, Zenith Electronics Corporation patented projection tubes.
Anode Voltage	Nominal, 30 KV.
Light Output	42 ft-lbts (foot-lamberts) nominal average center picture brightness with white field display.
Resolution	330 lines NTSC** video.
Power	108-132 volt, 60 Hz, nominal 160 watts.
RF Antenna Input	75 Ω, coaxial/300 Ω, twin lead through balun.
Dimensions	44-3/16″ W × 44-5/8″ H, 27-1/4″ D (1346.8 × 1360 × 830.6 cm).

Weight	270 lbs. (122.4 kg).
Speakers	Two 2-1/2″ and two 6-1/2″ round, 8 Ω impedance each.
Audio Power	5 watts rms minimum per channel continuous. 100 Hz to 10 kHz, 8 Ω, 2% or less total harmonic distortion.
Tuning Range	See "Television Broadcast Channels" on Pages 61-67.

* U.S Precision Lens
** National Television Standards Committee

CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath/Zenith Computers and Electronics centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH/ZENITH COMPUTER AND ELECTRONICS CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath/Zenith Computer and Electronics centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath/Zenith Computer and Electronics center.

TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? – Operation? — Call or write for assistance. You'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heath/Zenith Computer and Electronics center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heath/Zenith Computers and Electronics center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least THREE INCHES of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

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